Economic Rationality under Limited Attention: The Effect of Sequential Elimination

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Abstract

Evidence suggests that individual behavior may deviate from preference maximization due to limited attention to alternatives. I study this issue by developing a framework that incorporates choice procedures where individuals consider at least two available alternatives. I show that choices made under *sequential elimination* (where individuals sequentially eliminate alternatives until only one survives) always maximize preferences, whereas choices made directly from menus do not. Using a controlled experiment, I find that sequential elimination substantially improves individual consistency with preference maximization, especially for subjects with low cognitive ability. Moreover, I explore individual preferences for sequential elimination and their implications.

JEL codes: C90, D81, D91, G11, I31.

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1 Introduction

The standard principle of economic rationality requires individual behavior to be consistent with preference maximization. Abundant research, however, suggests that people often make choices inconsistent with preference maximization because of limited attention, which entails them only considering a limited set of available alternatives (e.g., Masatlioglu, Nakajima, and Ozbay, 2012; Dean, Kıbrıs, and Masatlioglu, 2017; Lleras et al., 2017). Furthermore, evidence of limited attention is widely observed in domains that naturally involve an overwhelming number of alternatives—such as bank loans (Honka, Hortaçsu, and Vitorino, 2017), health services (Gaynor, Propper, and Seiler, 2016), and insurance plans (Abaluck and Adams-Prassl, 2021)—thus posing a prominent welfare issue. Despite this wealth of research, there remains a substantial gap in the literature on improving economic rationality.

This paper presents the first study demonstrating how a simple *choice procedure* can boost individual consistency with preference maximization under limited attention. Since Simon (1955), the notion of choice procedures has been acknowledged for its fundamental role in shaping choice behavior (e.g., Salant, 2011; Oprea, 2020). Drawing on this notion, I develop a formal framework to study the impact of choice procedures on the consistency of a decision maker (DM) with a standard preference and limited attention. Importantly, I propose a *minimum property* of limited attention whereby the DM considers at least two alternatives when faced with a menu of multiple alternatives, based on the converging evidence from economics and the cognitive sciences.[1] I contribute to the literature by exploiting this property to open up the possibility of improving individual consistency through choice procedures.

The framework allows me to examine individual consistency under two notable choice procedures. One is the *direct procedure*, where the DM chooses directly from menus. In this procedure, limited attention may cause individual inconsistency due to the DM overlooking the best alternatives on menus. This leads me to investigate *sequential elimination*, in which the DM eliminates alternatives sequentially until only one survives. It has been extensively studied in marketing, psychology—and more recently,—economics (e.g., Masatlioglu and Nakajima, 2007; Manzini and Mariotti, 2007). In particular, the investigation is motivated by two strands of empirical evidence: First, sequential decision-making can mitigate choice overload (e.g., Besedeš et al., 2015); second, elimination-based decision-making can encourage people

[1] See Section 1.1 for a review of the evidence.

to consider more alternatives (e.g., Sokolova and Krishna, 2016). While sequential elimination intuitively combines the advantages of the two approaches, an in-depth analysis remains necessary to probe its impact and primary mechanism on individual consistency. Thus, I contribute to this literature through a choice-theoretic investigation of sequential elimination that provides testable implications.

I show that the DM makes choices consistent with preference maximization under sequential elimination. An intuitive explanation for this result is that one of the best alternatives in a menu survives in every elimination, either by not being considered or by beating the other alternatives in the set of considered alternatives. In effect, sequential elimination decomposes a taxing preference maximization problem into an equivalent sequence of manageable elimination subproblems. The result gives rise to the central hypothesis in this paper: individuals make choices with a higher level of consistency under sequential elimination than under the direct procedure. One implication of limited attention is its higher tendency to emerge among individuals with lower cognitive ability. Hence, to examine further validity of the framework, I formulate a sharper hypothesis; namely, that sequential elimination improves the consistency of individuals with low cognitive ability.

To test the hypotheses, I implement an experiment closely guided by this framework. The experiment measures individual consistency based on twenty risky decision problems, each representing a list of eleven portfolio options from a unique budget line. Every option rewards one of two amounts of money with equal probability. Given the simplicity of each option, the most challenging aspect of this setting presumably lies in individuals' limited attention to consider all available options. In other words, in addition to examining the impact of choice procedures on economic rationality, the setting can provide a meaningful interpretation of the impact in relevance to limited attention.

In the main experiment, subjects are randomly assigned to either the *Direct Procedure* or *Sequential Elimination* treatments, which are carefully controlled to have reasonably comparable instructions and interfaces.[2] Individual consistency is measured by the number of Generalized Axiom of Revealed Preference (GARP) violations; GARP is a necessary and sufficient condition for choices to be consistent with preference maximization (Afriat, 1967; Varian, 1982, 1983). Additionally, I provide an analysis of first-order stochastic dominance (FOSD) viola-

[2] See Section 3.1 for the details of the experimental treatments. Henceforth, where initially capitalized, the terms Direct Procedure and Sequential Elimination refer to the respective treatments in the experiment; otherwise, they refer to their respective general meanings.

tions, which are typically regarded as mistakes and do not imply GARP violations.[3] GARP is the core criterion for economic rationality, and FOSD complements GARP in decision-making under risk. More GARP or FOSD violations indicate a lower level of economic rationality. Lastly, cognitive ability is expressed as IQ scores obtained from the International Cognitive Ability Resource (ICAR) test (Condon and Revelle, 2014).

The main experimental results show that Sequential Elimination substantially reduces GARP violations by almost 76% (at the margin of statistical significance) and FOSD violations by nearly 65% (with statistical significance) as compared with the Direct Procedure. Furthermore, I find that Sequential Elimination leads to an economically (and statistically) significant, over 94%, reduction in the number of GARP violations committed by low-IQ subjects (i.e., those with below-or-equal-to-median IQ scores) when compared with the Direct Procedure. I find no evidence of the effect of Sequential Elimination on the consistency of high-IQ subjects (i.e., those with above-median IQ scores). Nevertheless, there is a remarkable decrease in the number of high-IQ subjects' FOSD violations by almost 99% (with statistical significance) attributable to Sequential Elimination relative to the Direct Procedure. These results provide causal evidence supporting the hypotheses, thereby narrowing the literature gap on improving economic rationality.

To further its real-world applications, I explore a liberal implementation of sequential elimination that accommodates individual preferences for choice procedures. To this end, the experiment employs a third treatment, referred to as the *Liberal Procedure*, where subjects are allowed to select one of the previous two treatments. I find suggestive evidence that the Liberal Procedure reduces GARP violations for low-IQ subjects and FOSD violations for high-IQ subjects as compared with the Direct Procedure, with magnitude and statistical significance approaching those of Sequential Elimination obtained from the main analysis. This may be driven by a strong preference for Sequential Elimination among low-IQ subjects and a moderate preference among high-IQ subjects. Altogether, the findings indicate that implementing sequential elimination as an optional procedure may still benefit individuals who prefer it.

This paper also contributes to the emerging experimental literature on choice procedures in two ways. First, the experiment enriches the literature by examining the impact of choice procedures based on the classical GARP axiom. Relatedly, recent studies have shown that viola-

[3] By committing a FOSD violation, subjects forgo an option that yields better outcomes than their choices, with no additional risk. In Section 3.1, I discuss other measures included to examine the effect of sequential elimination.

tions of relatively simple normative axioms (e.g., FOSD) can be reduced by the *choice revision* procedure, which gives people a chance to revise choices (e.g., Benjamin, Fontana, and Kimball, 2020; Breig and Feldman, 2020; Nielsen and Rehbeck, 2022). Still, the robustness of this effect remains to be determined in settings where limited attention may loom. By incorporating choice revision into the experiment, I find that it can complement sequential elimination in enhancing economic rationality.

Second, I investigate the impact of choice procedures on eliciting risk preferences. I find that the experiment reflects an overall negative relationship between cognitive ability and risk aversion, in line with the main findings of prior studies (see, e.g., Dohmen et al., 2018, for reviews). Further analysis reveals that this relationship is significant under Sequential Elimination but not under the Direct Procedure. The resulting evidence suggests that choice procedures play a crucial role in eliciting risk preferences, thus bridging the two strands of literature.

This paper gives rise to policy implications. First and foremost, sequential elimination is arguably intuitive and low-cost to use. These advantages enable it to be economically implemented in a variety of challenging decision problems, e.g., bank loans, health insurance, and pension plans, where limited attention may be detrimental to welfare. Moreover, sequential elimination can be implemented with a plausibly high degree of flexibility, e.g., policymakers can provide it as a public good, encouraging individuals to adopt it of their own accord. Finally, the paper illuminates the necessity of considering choice procedures in understanding individual preferences, which are of fundamental importance to public policy.

1.1 Related Literature

This paper builds on the growing literature on limited attention models. The models typically postulate that individuals directly choose from a limited set of alternatives on a menu, known as the *consideration set* (e.g., Masatlioglu, Nakajima, and Ozbay, 2012; Dean, Kıbrıs, and Masatlioglu, 2017; Lleras et al., 2017). Eliaz and Spiegler (2011) study the implications of consideration sets in a market competition setting. Further models incorporate the assumption that consideration sets are formed stochastically, such as Manzini and Mariotti (2014), Caplin, Dean, and Leahy (2019), and Cattaneo et al. (2020). More closely related to my work, Dardanoni et al. (2020) explicitly model consideration set sizes as a result of cognitive heterogeneity. I contribute to the literature by proposing the minimum property of limited attention, which finds firm support in various studies. For example, eye-tracking studies observe that subjects focus on at least two alternatives most of the time (Krajbich and Rangel, 2011; Reutskaja et al., 2011). Field evidence also suggests that individuals tend to form consideration sets containing at least two alternatives (Honka, Hortaçsu, and Vitorino, 2017; Barseghyan, Molinari, and Thirkettle, 2021). Furthermore, findings from the cognitive sciences show that the attention span of normal adult humans stretches beyond the processing of two objects (see, e.g., Cowan, 2001, for reviews), corroborating the minimum property.

Sequential elimination originates from the marketing and psychology literatures, where it has been proposed to simplify decision problems involving criteria, e.g., certain aspects of the alternatives (Tversky, 1972) or environmental cues (Gigerenzer and Todd, 1999; Todd and Gigerenzer, 2000). Recently, it has received growing attention in economics. Masatlioglu and Nakajima (2007) propose a model of choice by elimination where the DM chooses the remaining alternatives after eliminating all those that are dominated by another alternative on the menu. Inconsistency may arise in their model in which eliminations may depend on menus and may not apply to all menus. Differently, my framework focuses on menu-independent eliminations that occur across all non-singleton menus.

Further studies postulate that the DM may eliminate alternatives sequentially based on multiple acyclic relations (Manzini and Mariotti, 2007), a checklist of desirable properties (Mandler, Manzini, and Mariotti, 2012), or a particular order of binary comparisons (Apesteguia and Ballester, 2013). A common implication of the aforementioned models is that individuals may not intrinsically maximize one well-behaved preference relation. In contrast and importantly, this paper's central implication is that preference maximization may be impeded by factors extrinsic to preferences, e.g., limited attention, which choice procedures could alleviate.

Several experimental studies provide evidence in support of a potential improvement by sequential elimination in decision-making. Besedeš et al. (2015) show the impact of sequential decision-making in reducing choice overload. Specifically, they study a choice procedure known as the "sequential tournament" where subjects make choices from several rounds of smaller menus randomly separated from a larger one. The cited authors find that subjects are more likely to choose the option with the highest payment likelihood in the sequential tournament than choosing from the entire menu at once. Marketing and psychology studies consistently find that subjects consider more options in judgment tasks when eliminating than when choosing directly (Huber, Neale, and Northcraft, 1987; Yaniv and Schul, 1997, 2000; Sokolova and Krishna, 2016).

The general idea of sequential elimination is widely recommended in practice, such as career decisions (Gati, Fassa, and Houminer, 1995), managerial decision making (Stroh et al., 2003), patient counseling (Zikmund-Fisher, Angott, and Ubel, 2011), and criminal identification (Pica and Pozzulo, 2017).

This paper also adds to the revealed preference literature that investigates the determinants of economic rationality. For example, Harbaugh, Krause, and Berry (2001) find that senior students are more consistent than junior ones in primary schools. There is also experimental evidence that individual consistency is associated with market experience (List and Millimet, 2008) or cognitive skills (Burks et al., 2009). Based on a representative sample of Dutch households, Choi et al. (2014) find that female, low-income, low-education, and older households have, on average, lower levels of economic rationality. Dean and Martin (2016) find that retirement-age households are more consistent than younger households, using scanner data on representative households in Denver. However, Echenique, Imai, and Saito (2021) find that younger people (i.e., aged 16-34) comply with rationality more than older people (i.e., aged 65+) by leveraging the datasets from Choi et al. (2014), Carvalho, Meier, and Wang (2016), and Carvalho and Silverman (2019).

Despite the importance of economic rationality, few studies have explored how to improve it. Notably, Kim et al. (2018) exploit a field experiment that provides an education program for female students in Malawian secondary schools. They find causal evidence of education's impact on improving economic rationality, which operates partially through enhancing cognitive ability. Banks, Carvalho, and Perez-Arce (2019), on the other hand, find no evidence of education effects in a sample of people who have been affected by a compulsory schooling policy in England. I contribute to the literature by proposing a tractable choice-theoretical framework and, most importantly, by providing causal evidence from a controlled experiment.

The rest of the paper proceeds as follows. Section 2 presents the framework with which I derive the hypothesis. Section 3 describes the details of the experimental design. Section 4 provides the experimental results. Finally, Section 5 discusses the implications of the results and concludes.

2 Framework

Let $x \in \mathbb{R}^k_+$ be an alternative representing a bundle of k goods. Consider a finite data set $D = \{c^i, M^i\}_{i=1}^n$, where M^i is a finite menu of distinct alternatives and a DM chooses c^i from M^i. Let $X = \cup_{i=1}^n M^i$ be the set of all available alternatives and $\mathscr{X}$ be the set of all nonempty subsets of X. Let $\succeq$ be a complete, transitive, and monotone preference relation over X.[4]

In this paper, I assume that the DM has limited attention, i.e., when faced with a menu M, he pays attention to a limited set of alternatives on the menu, $\gamma(M)$, known as the consideration set. The DM's limited attention satisfies the minimum property, i.e., he pays attention to at least two alternatives when M comprises multiple alternatives. Formally, a *consideration set mapping* γ assigns to every $M \in \mathscr{X}$ a subset of M such that $|\gamma(M)| \geq \min\{|M|, 2\}$. A consideration set mapping is said to be a *full consideration* if for all $M \in \mathscr{X}$, $\gamma(M) = M$.

2.1 The Direct Procedure

I propose that under the direct procedure, the DM chooses an alternative that is preferred to all the others in his consideration set within a menu. The following definition is adapted from Masatlioglu, Nakajima, and Ozbay (2012).

Definition 1. The data set $D = \{c^i, M^i\}_{i=1}^n$ is *generated by the direct procedure* if there exist a preference relation $\succeq$ and a consideration set mapping γ such that for all i, $c^i \in \{x \in \gamma(M^i) | x \succeq y \; \forall y \in \gamma(M^i)\}$. Further, D is generated by the direct procedure with full consideration if γ is a full consideration.

I examine the DM's economic rationality by GARP, a necessary and sufficient condition for a data set D to be rationalized by a preference relation. A GARP violation in choices indicates an inconsistency from preference maximization; the more GARP violations, the more inconsistencies. I formally introduce GARP in the present setting by adapting Cosaert and Demuynck (2015)'s axiom of revealed preference for finite choice sets. For any pair of choices c^i and c^j, I denote that $c^i R^* c^j$ if there exists $x \in M^i$ such that $x \geq c^j$. In words, for any pair of choices, the first is revealed preferred to the second if the first menu contains an alternative offering weakly more goods than the second choice. I also denote that $c^i R c^j$ if there exists some

[4]A preference relation $\succeq$ is monotone if $x \geq y$ implies $x \succeq y$ and $x > y$ implies $x \succeq y$ but not $y \succeq x$.

sequence $i,h,g,...,m,j$ such that $c^iR^*c^h, c^hR^*c^g, ..., c^mR^*c^j$. That is, R is the transitive closure of R^*.

Definition 2 (GARP)**.** The data set $D = \{c^i, M^i\}_{i=1}^n$ satisfies the *Generalized Axiom of Revealed Preference* if for any pair of choices c^i and c^j, c^iRc^j implies there exists no $x \in M^j$ such that $x > c^i$.

Unless the DM considers every available alternative under the direct procedure, his choices do not necessarily satisfy GARP, as the following example shows. Consider two menus, $M^1 = \{x,y,z\}$ and $M^2 = \{u,v,w\}$ with $z > u$ and $w > x$. Suppose that the DM's preferences are described by $z \succeq w \succeq x \succeq u \succeq v \succeq y$ and his consideration sets are $\gamma(M^1) = \{x,y\}$ and $\gamma(M^2) = \{u,v\}$. Consequently, the DM's choices from M^1 and M^2 under the direct procedure are $c^1 = x$ and $c^2 = u$. We have that c^1Rc^2, but there exists $w \in M^2$ such that $w > c^1$; this violates GARP.

How may GARP violations depend on the size of consideration sets under the direct procedure? Consider a different case where the DM has full consideration. In this case, his choices under the direct procedure are $\tilde{c}^1 = z$ and $\tilde{c}^2 = w$, satisfying GARP. Intuitively, the number of GARP violations weakly decreases in the expansion of consideration sets because the DM would not make worse choices by attending to additional alternatives. In fact, it is equivalent for a data set to be generated by the direct procedure with full consideration and to be rationalized by standard preference maximization.

The following remark summarizes the above discussion, which will be useful later for formulating the hypotheses.

Remark 1. *Let $D = \{c^i, M^i\}_{i=1}^n$ and $\tilde{D} = \{\tilde{c}^i, M^i\}_{i=1}^n$ be two data sets, the following statements are true:*

(i) D does not necessarily satisfy GARP if D is generated by the direct procedure.

(ii) The number of GARP violations in D is weakly greater than that in $\tilde{D}$ if D ($\tilde{D}$, respectively) is generated by the direct procedure with a preference relation $\succeq$ and a consideration set mapping γ ($\tilde{\gamma}$, respectively) such that $\tilde{\gamma}(M^i) \supseteq \gamma(M^i)$ for all i.

(iii) D satisfies GARP if D is generated by the direct procedure with full consideration.

2.2 Sequential Elimination

Remark 1 implies that the DM may miss the best alternatives under the direct procedure by not giving menus full consideration. This paper's proposal for addressing this problem is to study sequential elimination, in which the DM eliminates alternatives sequentially until only one survives, i.e., the choice.

To illustrate sequential elimination, consider again that the DM is confronted with M^1. Under this procedure, he goes through two rounds of elimination to select an alternative from M^1. In the first round, he eliminates $e_1^1 = y$, leaving the menu to be $M^1 \backslash \{y\} = \{x, z\}$. In the second round, the DM confronts $\{x, z\}$ as a "new" menu, from which he eliminates $e_2^1 = x$, leaving the menu to be $M^1 \backslash \{y, x\} = \{z\}$ representing his choice under sequential elimination.

Formally, $E = \{e^i, M^i\}_{i=1}^n$ is an *elimination* data set, where e^i is a sequence of alternatives $e^i = (e_1^i, ..., e_{|M^i|}^i) \in \prod_{r=1}^{|M^i|} \mathbb{R}_+^k$ such that $\bigcup_{r=1}^{|M^i|} \{e_r^i\} = M^i$. The sequence e^i fully describes an elimination behavior of the DM with the interpretation that when confronted with a non-singleton menu M^i, he eliminates $e_1^i, ..., e_{|M^i|-1}^i$ sequentially, and finally chooses $e_{|M^i|}^i$ from M^i. For all i and $r = 1, .., |M^i|$, let E_r^i denote the remaining menu before the rth round of elimination by $E_r^i = \bigcup_{s=r}^{|M^i|} \{e_s^i\}$. I propose the following model of sequential elimination with limited attention.

Definition 3. The data set $D = \{c^i, M^i\}_{i=1}^n$ is *generated by sequential elimination* if there exist a preference relation $\succeq$, a consideration set mapping γ, and an elimination data set $E = \{e^i, M^i\}_{i=1}^n$ such that for all i and $r = 1, ..., |M^i|$,

(i) $e_r^i \in \gamma(E_r^i)$.

(ii) $\{x \in \gamma(E_r^i) | x \succeq e_r^i, x \neq e_r^i\} \neq \emptyset$ if $|E_r^i| \geq 2$.

(iii) $c^i = e_{|M^i|}^i$.

Definition 3 (i) and (ii) state that the DM eliminates an alternative from the consideration set if he prefers another alternative in this set. In other words, despite limited attention, the DM compares at least two alternatives according to his preferences in every elimination. The last condition relates an elimination data set to a choice data set by imposing the final remaining alternative to be the choice.

The following proposition formally establishes the consistency of the choice behavior under sequential elimination. All proofs are in Appendix A.

Proposition 1. *Let D be a data set. D satisfies GARP if and only if D is generated by sequential* *elimination.*

Proposition 1 shows that the DM always makes choices consistent with preference maximization under sequential elimination. Thanks to the minimum property of limited attention, one of the best alternatives survives in every elimination, according to one or other of the following two cases. One is that the DM does not consider this alternative, which remains on the menu. The other is that he considers this alternative, which beats all the others in the consideration set. As a result, instead of confronting a taxing problem, the DM sequentially solves an equivalent sequence of elimination subproblems, each of which is manageable within his attentional limitations.

Note that Remark 1 and Proposition 1 imply that if a data set satisfies GARP, we cannot identify the choice procedure that generated it. This poses no problem in the paper, which is motivated by extensive evidence of individual inconsistency with preference maximization.

2.3 Testable Implications

In light of Remark 1 and Proposition 1, a preference maximizer with limited attention satisfying the minimum property would make consistent choices under sequential elimination but would not necessarily do so under the direct procedure, unless applying full consideration. I take the premise that a sufficiently large portion of the population can be described as preference maximizers with limited attention satisfying the minimum property. Although the proportion of the population applying full consideration is unclear, it may be inferred from cognitive ability to some extent, since attention is highly dependent on cognitive ability (Kahneman, 1973). Individuals with low cognitive ability may attend to fewer alternatives than those with high cognitive ability. Taking these factors together, I reason that the population may behave in accordance with the implication of Remark 1 and Proposition 1, and more so in the case of those with low cognitive ability. In other words, I expect the following hypotheses to be true:

Hypothesis 1. *Individuals make choices with a higher level of consistency (i.e., fewer GARP violations) under sequential elimination than under the direct procedure.*

Hypothesis 2. *Individuals with low cognitive ability make choices with a higher level of consistency (i.e., fewer GARP violations) under sequential elimination than under the direct procedure.*

Two possibilities exist when a given sample of observations falsifies the hypotheses. One possibility is that the sample individuals have a sufficiently high enough level of cognitive ability to apply full consideration and thereby make consistent choices irrespective of the choice procedures. Thus, sequential elimination does not have a significant effect. This possibility can be verified by observing that individuals under both procedures make highly consistent choices. Another possibility is that most of the sample individuals deliberately make inconsistent choices (e.g., Kahneman, 2003; DellaVigna, 2009). In this case, I expect to observe a low level of individual consistency in both procedures.

3 Experimental Design

The overview of the experiment is as follows. After starting the experiment, subjects are randomly assigned to one of the three treatments, Direct Procedure, Sequential Elimination, or Liberal Procedure. Subjects are first asked to make economic decisions under their assigned choice procedures. They are then asked to complete cognitive ability tests. Finally, they are requested to complete a survey on additional information, including attitudes toward inconsistency and demographics. The details of the experimental design are discussed below.

3.1 Main Design

3.1.1 Measuring Economic Rationality

Guided by the framework, the experiment is designed to measure economic rationality based on its core criterion, individual consistency with preference maximization. Subjects' consistency levels are indicated as the numbers of GARP violations in their choices from twenty risky decision problems adapted from Kim et al. (2018).[5] Each decision problem comprises eleven randomly ordered distinct *options* from a budget line with a unique price and endowment combination. An option (x_1, x_2) rewards x_1 or x_2 tokens with equal probability. There is also one decision problem to check comprehension.[6] In addition, there is a choice revision design, which will be explained shortly in Section 3.2.1. In all treatments, subjects are asked to choose one option from every decision problem, which is displayed as a vertical list of options on the left-hand side of the screen.

[5] See Appendix B for a graphical illustration of a GARP violation in the experimental setting.

[6] The comprehension check problem comprises nine options: (11, 11), (22, 22), (33, 33), (44, 44), (55, 55), (66, 66), (77, 77), (88, 88), (99, 99). Subjects are identified as having failed the comprehension check if they did not choose (99, 99).

Choices in conformity with GARP might be rationalized by a preference relation that is considered normatively unappealing. As a complement to GARP violations, the number of first-order stochastic dominance (FOSD) violations in individual choices is also computed. To be specific, subjects commit a FOSD violation if they choose an option (x_1, x_2) when there exists another option (y_1, y_2) in the same problem such that $y_2 \geq x_1$ and $y_1 \geq x_2$. FOSD is proposed in decision theory as a fundamental criterion for rationality in decision-making under risk (Quiggin, 1990; Wakker, 1993) and has been widely applied in experiments as a measure of decision-making quality (Choi et al., 2014; Carvalho, Meier, and Wang, 2016; Kim et al., 2018; Banks, Carvalho, and Perez-Arce, 2019). A larger number of GARP or FOSD violations signals a lower level of economic rationality.

In robustness checks, individual consistency is additionally measured by the number of Strong Axiom of Revealed Preference (SARP) violations (Rose, 1958), the Houtman–Maks (HM) index (Houtman and Maks, 1985), and the critical cost efficiency index (CCEI, Afriat, 1972). SARP differs from GARP by excluding indifference between alternatives in a preference relation. The HM index finds the minimal removal of the observations such that the rest are consistent. The CCEI considers the minimal wealth change such that choices are consistent.[7] Accordingly, more SARP violations, a higher HM index, or a higher CCEI indicate a lower level of economic rationality.

3.1.2 Experimental Treatments

I begin by illustrating the treatment of principal interest, Sequential Elimination, under which subjects are asked to choose an option by eliminating all the other options sequentially. Subjects are asked to eliminate an option by clicking on it, which will appear in a "Trash" box on the right-hand side of the screen. To prevent mistakes due to unfamiliarity with eliminations, the treatment allows subjects to restore an eliminated option in the Trash box to the original options list by clicking on it. Potentially, the elimination instruction might expose subjects to every option to a greater degree. That is, the procedure's effect could be partially attributed to the instruction when compared with the direct procedure that does not explicitly direct individual attention to each option. This falls outside the scope of the framework and may hinder our interpretations of sequential elimination's effect and robustness.

[7] See also Apesteguia and Ballester (2015) and Halevy, Persitz, and Zrill (2018) for detailed discussions of rationality measures. As the CCEI assumes that choices are made from linear budget sets instead of finite sets of options, it may be less sensitive to changes in individual consistency than the other measures in the present setting.

To mitigate this concern, the experiment adapts the direct procedure to have analogous experimental instructions and interfaces with Sequential Elimination. The adapted treatment is referred to as the Direct Procedure, under which subjects are asked to choose an option after "examining" all the options sequentially.[8] Subjects are asked to examine an option by clicking on it, which will appear in a "Choice List" box on the right-hand side of the screen and cannot be moved back to the original options list. Subjects are asked to make a choice from the Choice List once it contains all the options. The two treatments expose subjects to options similarly and differ only in how choices are made, thus enabling critical testing of the hypotheses and providing a precise interpretation (and, to some extent, a lower bound) of sequential elimination's effect.

Lastly, under the Liberal Procedure treatment, subjects are asked to select either one of the Direct Procedure and Sequential Elimination as their choice procedures.[9] This treatment enables the investigation of two key questions relating to sequential elimination. Firstly, what is the impact of implementing sequential elimination in a liberal way that accords with individual preferences? Secondly, what are the determinants of individual preferences for sequential elimination?

3.1.3 Measuring Cognitive Ability

Cognitive ability is expressed as IQ scores derived from the ICAR test. In this test, subjects are asked to complete five matrix reasoning and five three-dimensional rotation questions, which are considered the primary measure of problem-solving and reasoning abilities (Nisbett et al., 2012). The number of correct answers (i.e., an integer between 0 and 10) provides the test score. The experiment also includes tests of selective attention and working memory capacity, which are closely related to the notion of limited attention.[10] Selective attention is measured by the Stroop test (Stroop, 1935) where subjects are presented with a word, say, GREEN, printed in the same or a different color, say, red, and asked to name the colors in which the words are printed. Working memory capacity is measured by the Sternberg test (Sternberg, 1966), where

[8]In the experiment, the Direct Procedure is introduced to subjects as "Sequential Examination".

[9]See Appendix B for screenshots of all treatments. The Direct Procedure and Sequential Elimination subjects are given a trial problem to practice the procedures. The Liberal Procedure subjects are given a trial problem with the two procedures randomly ordered.

[10]See Appendix B for the details of the cognitive ability tests. The tests are implemented via the platform of Henninger et al. (2022). Selective attention refers to the differential processing of simultaneous information sources (Johnston and Dark, 1986). Working memory capacity refers to the capacity for "temporary storage and manipulation of the information" (Baddeley, 1992). Oberauer (2019) reviews the close relationship between working memory and attention.

subjects see a sequence of numbers presented singly and are asked to remember them. After a few numbers have been shown, there is a brief pause, and then a test number appears. Subjects are asked whether the test number was included in the sequence previously shown. At the end of a trial, subjects are asked to recall the sequence of numbers previously shown.

3.2 Other Details of the Experimental Design

3.2.1 Choice Revision

The experiment employs a choice revision design to investigate whether it can mitigate the impact of limited attention. The comparison between the effects of choice revision and sequential elimination may provide further insight into both procedures.

In the experiment, subjects are asked to make decisions for two identical blocks of decision problems, Blocks A and B, each containing the set of decision problems described in Section 3.1.1. Subjects are not informed of the identical nature of the two blocks until they enter Block B. The decision problems are ordered randomly within each block and independently between them. In a Block B problem, the choice made in the respective problem in Block A is highlighted. Subjects can either restart the choice procedure by clicking on any option or keep this block A choice directly by clicking on a shortcut button.

Subjects are informed that they will have to choose one block for payment (referred to as the "payment block"), from which one decision problem is randomly drawn for the payoff. Thus, the two blocks are equally incentive-compatible.[11] This choice revision design does not involve presenting normative axioms, similar to the ones used in Gaudeul and Crosetto (2019) and Yu, Zhang, and Zuo (2021).

Subjects are labeled as "revisers" (i.e., those who have revised their choices) if they alter at least one choice from Block A to Block B and choose Block B for payment. I investigate the effect of choice revision by examining the difference in the payment block choices between revisers and non-revisers (according to GARP and FOSD). The rest of the experimental analysis focuses on Block A choices.

[11] Evidence from Agranov and Ortoleva (2017) suggests that individuals may deliberately make different choices when faced with repetitive problems. Requiring subjects to choose the payment block avoids this issue, as each problem is unique to subjects in terms of providing incentives.

3.2.2 Attitude toward Inconsistency

Some studies point out that, in some individuals, inconsistency of choices is deliberate (e.g., Kahneman, 2003; DellaVigna, 2009). The experiment elicits individual attitudes toward inconsistency to account for this possible underlying factor on individual rationality. Subjects are presented with a scenario that includes the presence of the attraction effect (Huber, Payne, and Puto, 1982), which is a common behavioral phenomenon of inconsistency (Tversky and Simonson, 1993). Subjects are asked to rate how at ease they are with the scenario on a scale of 0 (least at ease) to 10 (most at ease). This rating provides an indicator of individual attitude toward inconsistency, i.e., the higher the rating, the less negative the attitude toward inconsistency.

3.3 Experimental Procedure

The experiment was conducted online using the Qualtrics platform on May 31 and June 1, 2020. Subjects were recruited from the Prolific subject pool and could withdraw from the experiment at any time with no need for justification. Each subject received £3 as a participation fee for completing the experiment. There was an additional payment of up to £14.6 depending on the economic decisions and the performance in cognitive ability tests. Subjects received payoffs based on their earned tokens three days after the experiment via Prolific. The average completion time for the experiment was 42 minutes, and the average payout was £8.14.

The analysis is based on a sample of 223 subjects (50.2% female) and 73-75 observations per treatment.[12] By design, cognitive ability and demographics are balanced across the three treatments. The mean age is approximately 24, and 75% of the subjects are aged between 18 and 25. All subjects have completed at least secondary education. Specifically, 57% of the subjects are currently in undergraduate education, and 39% have completed at least undergraduate education. In other words, the sample subjects are probably younger and more educated than the population on average.

To test Hypothesis 2, I categorize subjects into two groups based on cognitive ability: (1) low-IQ subjects, whose IQ scores are lower than or equal to the sample median; (2) high-IQ subjects, whose IQ scores are higher than the sample median.[13] Table 1 presents the breakdown

[12]A total of 253 (53.1% female) subjects were recruited. They all spoke English as their first language and were allowed to complete the experiment only once. Thirty subjects who failed the comprehension check were filtered out. Appendix C gives the histograms of cognitive ability and demographics for the overall sample and per treatment.

[13]The sample median IQ score is 4, the mean is about 4.74, and the standard deviation is about 2.47. In the

of subjects by treatment and IQ. In the Liberal Procedure, 32 (82%) of the low-IQ subjects and 17 (47.2%) of the high-IQ subjects choose Sequential Elimination.

TABLE 1. BREAKDOWN OF OBSERVATIONS

Treatment / IQ Group	Direct Procedure	Sequential Elimination	Liberal Procedure
Low-IQ subjects	34 (45.3%)	40 (54.8%)	39 (52%)
High-IQ subjects	41 (54.7%)	33 (45.2%)	36 (48%)
Total	75 (100%)	73 (100%)	75 (100%)

4 Experimental Results

4.1 Main Results

This section examines the hypotheses by analyzing the observed differences between the Direct Procedure and Sequential Elimination. I present descriptive statistics for each hypothesis. Moreover, I perform negative binomial regression analysis to test for the effect of Sequential Elimination on GARP and FOSD violations because of their count data nature (Cameron and Trivedi, 2013), incorporating a complete set of control variables (e.g., cognitive ability and demographics).[14]

I start by discussing the evidence for Hypothesis 1. Figure 1(a) shows that subjects commit, on average, about 27% fewer GARP violations under Sequential Elimination than under the Direct Procedure (4.32 vs. 5.93 GARP violations, respectively). From Figure 2(a), we can also see that the empirical cumulative distribution function (eCDF) of GARP violations in the Direct Procedure almost (first-order) stochastically dominates that in Sequential Elimination, except on the extreme right tails of the distributions. The descriptive results indicate that subjects are more likely to commit more GARP violations under the Direct Procedure than under Sequential

sample, the IQ scores range from 0 to 10, with 3 and 6 being the first and third quantiles, respectively. Note that low-IQ (high-IQ, respectively) subjects identically match those with IQ scores lower than (higher than, respectively) the sample mean IQ score.

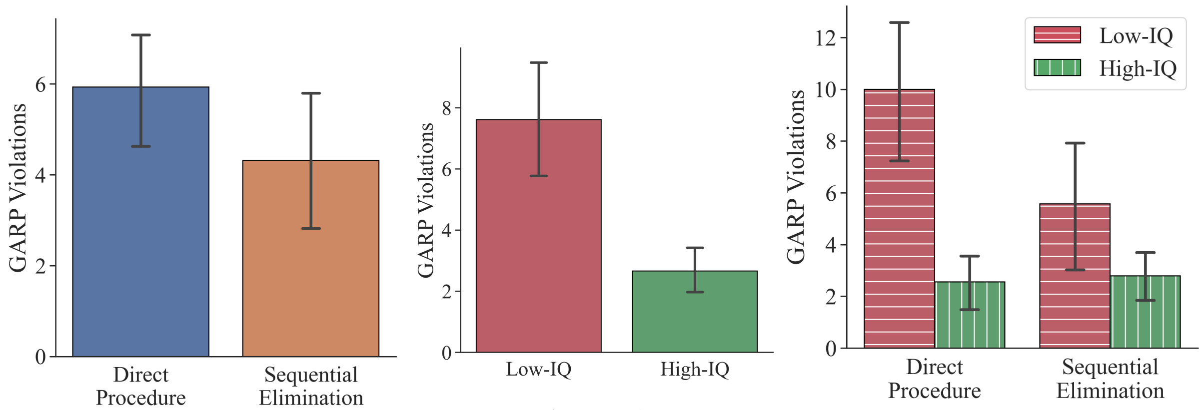
[14]Nonlinear regressions are widely applied in economics for nonnegative integer data, e.g., R&D patents (Acemoglu, Moscona, and Robinson, 2016), conflicts and wars (Crost, Felter, and Johnston, 2014), level-k reasoning (Camerer, Ho, and Chong, 2004), and revealed preference analysis (Choi et al., 2014). Cameron and Trivedi (2013) recommend the Poisson and negative binomial models for count data. Appendix E reports the model selection procedure, where the negative binomial model is selected based on conventional criteria. Because Hypotheses 1 and 2 are directional, one-tailed hypothesis tests are performed to assess the effects of Sequential Elimination on individual consistency overall and for low-IQ subjects. All other results are reported based on two-tailed hypothesis tests.

Elimination, thus providing preliminary evidence for Hypothesis 1.

Column 1 of Table 2 presents estimates of the effect of Sequential Elimination on individual consistency. The estimate represents that Sequential Elimination reduces the number of GARP violations by 4.48 at the margin of statistical significance ($p = 0.07$). This indicates that Sequential Elimination leads to a substantial reduction of over 76% in low-IQ subjects' inconsistencies as compared with the Direct Procedure, thereby supporting Hypothesis 1. The same column shows a significant positive association between high-IQ and individual consistency ($p = 0.01$), in line with previous studies (e.g., Burks et al., 2009; Cappelen et al., 2020). Indeed, high-IQ subjects are very consistent, both overall (see Figure 1(b)), and per treatment (see Figure 1(c)). Collectively, these results suggest that the impact of sequential elimination in improving individual consistency operates mainly through its effect on low-IQ subjects; this leads us to the following discussion on Hypothesis 2.

Figure 1(c) illustrates the descriptive evidence of Hypothesis 2. On average, the occurrence of GARP violations among low-IQ subjects is approximately 44.2% lower in Sequential Elimination than in the Direct Procedure (5.58 vs. 10 GARP violations, respectively). Additionally, Figure 2(b) displays that the eCDF of GARP violations by low-IQ subjects in the Direct Procedure strongly (first-order) stochastically dominates that in Sequential Elimination, except on the extreme right tails of the distributions. Column 1 of Table 2 shows that Sequential Elimination significantly reduces the number of GARP violations among low-IQ subjects by nearly 9.41 ($p = 0.04$), that is, over 94% of their average GARP violations in the Direct Procedure. This estimate illustrates the Sequential Elimination's economically meaningful effect on improving the consistency of low-IQ subjects, thus providing compelling evidence for Hypothesis 2. The estimates in Column 1 indicate that the treatment effect on low-IQ subjects is more pronounced than the overall treatment effect; put in another way, the former is the key driver of the latter.

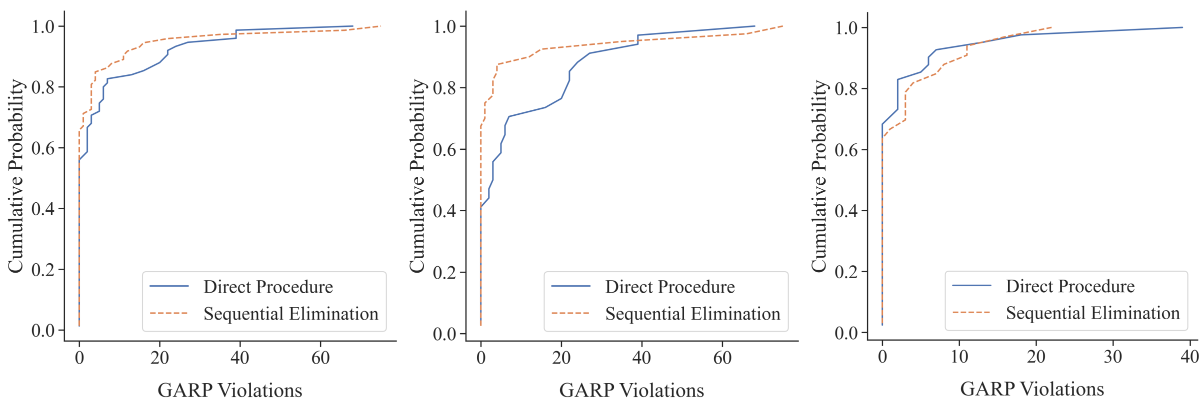
Besides individual consistency, Table 2 depicts the effect of Sequential Elimination on FOSD violations in Column 2. Overall, Sequential Elimination results in a decrease in the number of FOSD violations by almost 0.52 ($p = 0.02$), that is, 65% of the average 0.8 FOSD violations in the Direct Procedure. In contrast to what was observed for GARP violations, no significant difference in FOSD violations between low-IQ and high-IQ subjects can be seen. I neither find a significant treatment effect on FOSD violations for low-IQ subjects. High-IQ subjects, on the other hand, show nearly 0.92 (almost 99%, $p = 0.04$) fewer FOSD violations under Sequential Elimination than under the Direct Procedure (on average, about 0.93 FOSD



(a) BY TREATMENT (b) BY IQ (c) BY TREATMENT×IQ

FIGURE 1. GROUP-BY-GROUP MEANS OF GARP VIOLATIONS

Notes: Error bars indicate the standard error of means.



(a) ALL SUBJECTS (b) LOW-IQ SUBJECTS (c) HIGH-IQ SUBJECTS

FIGURE 2. GROUP-BY-GROUP EMPIRICAL CUMULATIVE DISTRIBUTION FUNCTIONS OF GARP VIOLATIONS

violations). The findings suggest that, when it comes to enhancing individual compliance with FOSD, sequential elimination may need to be combined with high cognitive ability.

The effect of Sequential Elimination is further corroborated by testing its sensitivity to other specifications, as reported in Appendix D. First, I verify that its effect on GARP violations remains robust to the estimation specifications where, instead of the dummy variable "high-IQ", the numeric variable "IQ" or finer categorizations of IQ groups are included. Moreover, the effect is coherently substantial among subjects with IQ scores in the lowest tiers. Second, the analysis shows that the effect of Sequential Elimination persists overall ($p = 0.08$) and for low-IQ subjects ($p = 0.04$) when examined based on SARP violations. The effect for low-IQ

TABLE 2. DETERMINANTS OF ECONOMIC RATIONALITY

	GARP violations (1)	FOSD violations (2)
Sequential Elimination	-4.480*	-0.515**
	(3.045)	(0.215)
-Low-IQ subjects	-9.409**	-0.226
	(5.246)	(0.233)
-High-IQ subjects	0.799	-0.917**
	(1.302)	(0.434)
High-IQ	-7.300**	0.145
	(2.900)	(0.211)
Selective attention	-0.283	-0.030
	(0.373)	(0.031)
Working memory	-0.357	-0.045
	(0.500)	(0.051)
Age	-0.456*	-0.064***
	(0.253)	(0.024)
Female	0.885	0.170
	(2.138)	(0.177)
Education	-1.232	0.212
	(1.339)	(0.133)
Response time (minutes)	-0.491**	0.012
	(0.229)	(0.020)
Attitude toward inconsistency	-0.840	0.021
	(0.511)	(0.033)
N	148	148

Notes: This table reports the average marginal effects resulting from negative binomial regressions of GARP and FOSD violations on the interaction between the variables “Sequential Elimination” and “high-IQ” as well as a complete set of control variables. The variable “Sequential Elimination” is a dummy that takes the value 1 if the subjects are in the Sequential Elimination and 0 if they are in the Direct Procedure. The variable “high-IQ” is a dummy that takes the value 1 if the subjects are in the high-IQ group. Robust standard errors are reported in parentheses. The regressions are reported in the original form in Appendix E. Reported p-values for the tests of Sequential Elimination’s effects on GARP violations overall and for low-IQ subjects are based on one-tailed hypothesis tests. All other significance levels are based upon two-tailed hypothesis tests. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

subjects also remains marginally significant when it comes to the HM index ($p = 0.10$) or CCEI ($p = 0.14$). Lastly, the nonparametric tests reach the same conclusion as the regression analysis, confirming the hypotheses.[15]

[15] Appendix D also analyses individual behaviors during the two treatments. I find a tendency of subjects to examine options following presentation orders under the Direct Procedure, regardless of their cognitive ability, whereas a tendency to eliminate options following presentation orders under Sequential Elimination is much less pronounced. Nevertheless, no significant difference in the associations of choices with their presentation positions between the two treatments is observed.

In summary, this section provides causal evidence of sequential elimination's impact on improving economic rationality, as demonstrated by the profound reductions in GARP (especially among individuals with low cognitive ability) and FOSD violations (especially among individuals with high cognitive ability).

4.2 Other Factors of Economic Rationality

This section investigates other potential factors of economic rationality in the experiment and compares their impacts with prior studies. The present study arguably differs from others in that it comprises primarily young and educated subjects, thereby enabling new implications for economic rationality to be explored.

As shown in Table 2, higher age corresponds to a higher level of economic rationality, i.e., fewer GARP ($p = 0.07$) and FOSD violations ($p < 0.01$); this is similar to Dean and Martin (2016), but not to Choi et al. (2014) or Echenique, Imai, and Saito (2021). The negative impact of age on decision-making found in the literature is plausibly attributable to the association between normal aging and cognitive decline. Yet young people may not have this issue (Rönnlund et al., 2005); moreover, they could accumulate knowledge required for decision-making by aging (Eberhardt, de Bruin, and Strough, 2019). Therefore, marginal returns of aging may outweigh marginal costs among the young population, resulting in a positive relationship between age and economic rationality. This relationship, together with prior research, suggests that the effect of age on economic rationality varies by age group.

The education effect is not significant, in line with Banks, Carvalho, and Perez-Arce (2019), while contrary to Choi et al. (2014) and Kim et al. (2018). This indicates that the marginal returns to education on economic rationality may be limited at high education levels, consistent with the findings of diminishing marginal returns to education in other contexts (e.g., Harris, 2007; Agüero and Beleche, 2013). The experiment reveals no gender difference in economic rationality, in contrast to Choi et al. (2014), suggesting that such a difference might depend on experimental settings and sample characteristics.

Lastly, longer response times are associated with fewer GARP violations ($p = 0.03$). The association implies that slower decisions are more consistent with preference maximization, in accordance with the trade-off between fast decisions and high accuracy (Fitts, 1966; Wickelgren, 1977). This finding, obtained from a limited attention setting, adds evidence to the role of response time in revealed preference analysis (Alós-Ferrer, Fehr, and Netzer, 2021).

4.3 Impact of the Liberal Procedure

This section examines the impact of the Liberal Procedure on economic rationality, using the Direct Procedure as a baseline. Table 3 reports results for this specification (where the same set of control variables as in Table 2 is employed). The estimate in the first column provides suggestive evidence that the Liberal Procedure decreases low-IQ subjects' GARP violations by almost 8.45 ($p = 0.12$), which is virtually 85% of their Direct Procedure average. According to the other column, the Liberal Procedure also yields a marginally significant reduction in the number of FOSD violations ($p = 0.09$). In particular, it significantly reduces high-IQ subjects' FOSD violation by almost 0.88 (nearly 95%, $p < 0.01$) as compared with the Direct Procedure. Most importantly, these effects of the Liberal Procedure are approaching those of Sequential Elimination in terms of magnitude and statistical significance.

TABLE 3. EFFECTS OF THE LIBERAL PROCEDURE ON ECONOMIC RATIONALITY

	GARP violations (1)	FOSD violations (2)
Liberal Procedure	-3.009	-0.301*
	(3.232)	(0.182)
-Low-IQ subjects	-8.449	0.101
	(5.488)	(0.222)
-High-IQ subjects	3.275	-0.877***
	(2.454)	(0.292)
N	150	150

Notes: This table reports the average marginal effects resulting from negative binomial regressions of GARP and FOSD violations on the interaction between the variables "Liberal Procedure" and "high-IQ" as well as a complete set of control variables. The variable "Liberal Procedure" is a dummy that takes the value 1 if the subjects are in the Liberal Procedure and 0 if they are in the Direct Procedure. Control variables not shown in this table: high-IQ, selective attention, working memory, age, female, education, response time, and attitude toward inconsistency. Robust standard errors are reported in parentheses. The complete table and the regressions in the original form are reported in Appendix E. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The analysis continues by investigating the determinants of individual preferences for sequential elimination. Table 4 presents the results from probit regressions, where the probability of choosing Sequential Elimination is regressed on cognitive ability, demographics, and attitude toward inconsistency. Column 1 of the table shows that the probability of choosing Sequential Elimination declines, *ceteris paribus*, as IQ ($p = 0.04$), working memory ($p = 0.07$), or probably selective attention ($p = 0.13$) increase. These effects are robust to the specification in Column 2, which includes the variable "high-IQ" ($p = 0.07$) instead of "IQ". In other words, subjects with lower (vs. higher) cognitive ability are more likely to use sequential elimination. Based on the estimates, among non-cognitive ability factors, only education has a significantly positive effect on the decision to use Sequential Elimination ($p < 0.01$ in Column 1, and $p = 0.01$ in Column 2). This highlights the instrumental role of education in facilitating the use of sequential elimination.

TABLE 4. DETERMINANTS OF INDIVIDUAL PREFERENCES FOR SEQUENTIAL ELIMINATION

	Probability of choosing Sequential Elimination	
	(1)	(2)
IQ	-0.042**	
	(0.019)	
High-IQ		-0.205*
		(0.117)
Selective attention	-0.025	-0.023
	(0.016)	(0.016)
Working memory	-0.038*	-0.041**
	(0.020)	(0.021)
Age	-0.004	-0.006
	(0.007)	(0.007)
Female	0.110	0.113
	(0.094)	(0.097)
Education	0.114***	0.112**
	(0.043)	(0.044)
Attitude toward inconsistency	0.003	0.006
	(0.019)	(0.020)
N	75	75

Notes: This table reports the average marginal effects resulting from probit regression analyses of the probability of choosing Sequential Elimination. Robust standard errors are reported in parentheses. The regressions are reported in their original form in Appendix E. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

In brief, the evidence suggests that individuals with lower (vs. higher) cognitive ability, who may be more burdened with limited attention, have a stronger preference for sequential elimination. In this regard, sequential elimination could also enhance economic rationality under limited attention when implemented in conformity with individual preferences for choice procedures, as evidenced by the Liberal Procedure.

4.4 Impact of Choice Revision

This section explores whether choice revision influences economic rationality in the present setting. Table 5 displays the results from estimating the effects of choice revision on GARP and FOSD violations, incorporating its interaction between Sequential Elimination and the same control variables as before.

Column 1 of the table shows that choice revision has a suggestively significant effect on mitigating GARP violations overall ($p = 0.18$). A plausible explanation for the insufficiency of evidence may be the reduced inconsistencies attributed to Sequential Elimination. The effect becomes larger in size for the Direct Procedure subjects ($p = 0.21$), but it is less pronounced than the effect of Sequential Elimination found in the main analysis. The comparison, to some degree, highlights the sequential elimination's effectiveness in improving individual consistency under limited attention. Column 2 indicates that the effect of choice revision in decreasing FOSD violations is on the verge of significance ($p = 0.13$). Furthermore, this effect is most evident under Sequential Elimination, where revisers commit 0.45 (about 63%, $p = 0.03$) fewer FOSD violations than non-revisers (on average 0.71 FOSD violations).

All in all, the results show that choice revision has some potential to reduce FOSD violations, primarily when it is combined with sequential elimination. This complements the growing literature on choice revision by illustrating when it can be effective in a limited attention setting.

4.5 Eliciting Risk Preferences under Choice Procedures

This section presents an analysis of individual risk preferences under the Direct Procedure and Sequential Elimination. Although the literature tends to find a negative relationship between cognitive ability and risk aversion (e.g., Dohmen et al., 2010; Benjamin, Brown, and Shapiro, 2013; Dohmen et al., 2018), this relationship cannot always be replicated and sometimes even becomes positive (Mather et al., 2012; Tymula et al., 2012; Andersson et al., 2016). Specifically, Andersson et al. (2016) find a positive relationship in a non-standard multiple-price list (MPL) setting where there are more opportunities to err toward the risky option. They argue that eliciting risk preferences of individuals with lower cognitive ability is subject to choice settings, which might cause different decision mistakes among those individuals.

Recall the theoretical prediction that individuals may err because of limited attention under the Direct Procedure but not under Sequential Elimination. The existing studies typically derive

TABLE 5. EFFECTS OF CHOICE REVISION ON ECONOMIC RATIONALITY

	GARP violations (1)	FOSD violations (2)
Choice revision	-2.936	-0.322
	(2.172)	(0.212)
- Under the Direct Procedure	-4.012	-0.185
	(3.189)	(0.373)
- Under Sequential Elimination	-1.690	-0.445**
	(2.815)	(0.203)
N	148	148

Notes: This table reports the average marginal effects resulting from negative binomial regressions of GARP and FOSD violations on the interaction between the variables "choice revision" and "Sequential Elimination" as well as a complete set of control variables. The variable "choice revision" is a dummy that takes the value 1 if the subjects have revised choices. The variable "Sequential Elimination" is a dummy that takes the value 1 if the subjects are in the Sequential Elimination and 0 if they are in the Direct Procedure. Control variables not shown in this table: high-IQ, selective attention, working memory, age, female, education, response time, and attitude toward inconsistency. Robust standard errors are reported in parentheses. The complete table and the regressions in the original form are reported in Appendix E. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

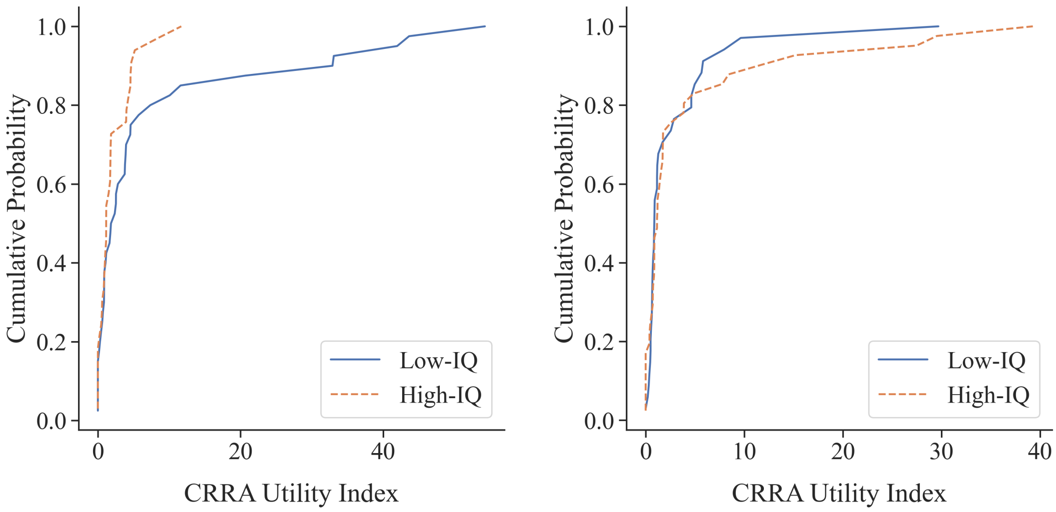
their results from arguably simple choice settings where decisions comprise two or three options. Hence, the following analysis contributes to the discussion by examining the relationships between cognitive ability and risk preferences under the two procedures in a relatively complicated choice setting.

Subjects' risk preferences are indicated by the constant relative risk aversion (CRRA) utility indices revealed from the choice data.[16] Table 6 presents the results from ordinary least squares regressions with two specifications. In Column 1, the CRRA utility index is regressed on IQ, Sequential Elimination, and a complete set of control variables. A negative, albeit marginally significant, association is observed between IQ and CRRA utility index ($p = 0.09$), coinciding with early reported findings. No other factor, including Sequential Elimination, appears to be associated with risk aversion.

Conjecturally, the association between elicited risk preferences and cognitive ability may hinge on choice procedures, given the previous results on individual consistency. This is supported by Figure 3(a), which depicts that, under Sequential Elimination, the eCDF of the CRRA utility indices of the low-IQ subjects almost stochastically dominates that of the high-IQ subjects. As shown in Figure 3(b), in contrast, the distinction between the two groups under the

[16]Assuming the CRRA expected utility model, the CRRA utility indices are recovered using the nonlinear least squares model; this is implemented via the code packages of Halevy, Persitz, and Zrill (2018).

Direct Procedure is much less salient. The estimation in Column 2 incorporates the interaction between IQ and Sequential Elimination in addition to the specification in Column 1. Verifying the conjecture, the association between IQ and the CRRA utility index is significant ($p = 0.04$) in Sequential Elimination but not in the Direct Procedure. Furthermore, the association is more pronounced in Sequential Elimination than in the overall sample.



(a) SEQUENTIAL ELIMINATION (b) DIRECT PROCEDURE

FIGURE 3. GROUP-BY-GROUP EMPIRICAL CUMULATIVE DISTRIBUTIONS OF REVEALED CRRA UTILITY INDICES

This section's findings complement the literature on eliciting risk preferences by highlighting the role of choice procedures. The negative relationship between cognitive ability and risk aversion is confirmed under sequential elimination, where individual consistency is theoretically established and experimentally supported by the previous results of this paper. The choices made by low-IQ subjects under the Direct Procedure may not fully reveal their risk preferences, possibly as a result of mistakes caused by limited attention, as would be consonant with Andersson et al. (2016). In other words, sequential elimination might enhance the elicitation of risk preferences in some crucial and often complicated decision problems, where the identification of individual preferences is essential for policy-making.

5 Discussion and Conclusions

This paper has demonstrated theoretically and experimentally that sequential elimination—a well-known choice procedure, especially in the cognitive sciences (e.g., Tversky, 1972; Todd

TABLE 6. EFFECTS OF SEQUENTIAL ELIMINATION ON ELICITED RISK PREFERENCES

	CRRA utility index	
	(1)	(2)
IQ	-0.397*	-0.358
	(0.230)	(0.227)
-Under the Direct Procedure		0.071
		(0.320)
-Under Sequential Elimination		-0.799**
		(0.397)
Sequential Elimination	2.010	2.063
	(1.619)	(1.628)
N	148	148

Notes: This table reports the average marginal effects resulting from OLS regression analyses of CRRA utility indices. The estimation in Column (1) includes the variables "IQ" and "Sequential Elimination" as well as a complete set of control variables. The estimation in Column (2) adds the interaction between the variables "IQ" and "Sequential Elimination". The variable "Sequential Elimination" is a dummy that takes the value 1 if the subjects are in the Sequential Elimination and 0 if they are in the Direct Procedure. Robust standard errors are reported in parentheses. Control variables not shown in this table: age, female, education, selective attention, working memory, response time, and attitude toward inconsistency. Robust standard errors are reported in parentheses. The complete table and the regressions in the original form are reported in Appendix E. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

and Gigerenzer, 2000)—improves economic rationality under limited attention. I develop a formal framework to identify the role of sequential elimination in improving individual consistency with preference maximization. Causal evidence for a sequential elimination effect is obtained for subjects participating in a randomized controlled risky decision-making experiment. This effect is economically meaningful, especially for individuals with low cognitive ability. Notably, the literature on economic rationality is enriched by the identification of theoretical and empirical conditions under which individual consistency is revealed. The results showing that sequential elimination considerably narrows the decision-making gap between individuals with low and high cognitive abilities may provide implications for reducing economic inequality in society.

The paper may also offer new insight into economic theories accounting for individual inconsistency with preference maximization. As this widely recognized anomaly poses a central challenge to neoclassical economics, an extensive amount of research has been dedicated to understanding how choice procedures may *describe* individual inconsistency (e.g., Manzini and Mariotti, 2007; Masatlioglu and Nakajima, 2007). This paper adopts the alternative approach that explores how choice procedures may *influence* individual inconsistency. The findings here do not undermine the existing theories from a descriptive perspective but rather highlight their potential in normative applications, which perhaps merit further investigation (Gilboa, 2010).

Thanks to its simplicity, sequential elimination can be employed by policymakers and institutions in a wide range of contexts to support individual decision-making at a reasonably low cost. For example, financial institutions may be required to provide the procedure to people who choose a loan scheme, a retirement plan, or an insurance policy. Alternatively, governments can provide the procedure on a website or mobile app for individuals to make these decisions. In this paper, I present an application of the procedure that is practically employable in these contexts beyond the present experiment.

In addition, my framework may complement implementations of sequential elimination by providing intuitive explanations of its effect and mechanism to the general public. The framework implies that it is sufficient for individuals to consider only two alternatives in every elimination to achieve consistency. It may be efficient for less cognitively constrained individuals to eliminate more than one alternative at a time. In effect, the procedure works as long as a person eliminates strictly fewer alternatives than he can consider at once. Future studies may seek to identify sequential elimination variations that enhance its efficiency.

Furthermore, the results suggest that providing sequential elimination as an optional procedure could improve individual decision-making, conceivably because individuals with low cognitive ability are likely to use this procedure on their own accord. In other words, policymakers and institutions may need only to offer individuals sequential elimination. This liberal approach of implementing sequential elimination inflicts little or no harm on individuals, thus making it ideal for institutional design (Thaler and Sunstein, 2003; Chetty, 2015). More broadly, sequential elimination and its variations might be applied to numerous meaningful contexts across a person's life cycle—spanning from education, through career, to financial decisions—where most people long for the "best" choice but are often overwhelmed by the number of options.

Beyond decision-making under risk, it would be desirable to test the robustness of sequential elimination in different choice domains, such as consumer goods, intertemporal choices, and altruistic choices. Perhaps most importantly, field research into sequential elimination presents a promising line of research. Finally, the paper may spur an intensified drive to develop choice procedures that lead to a more appreciable improvement than sequential elimination and can be recommended to individuals who struggle with preference maximization because of fundamental issues other than limited attention.

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Online Appendix
Not For Publication

Table of Contents

A Proof of Proposition 1

Let $D = \{c^i, M^i\}_{i=1}^n$ be a data set. Consider the following conditions:

[1] D satisfies GARP.

[2] D is generated by sequential elimination.

[3] There exists a preference relation $\succeq$ over X such that for all i, $c^i \in \{x \in M^i | x \succeq y \; \forall y \in M^i\}$.

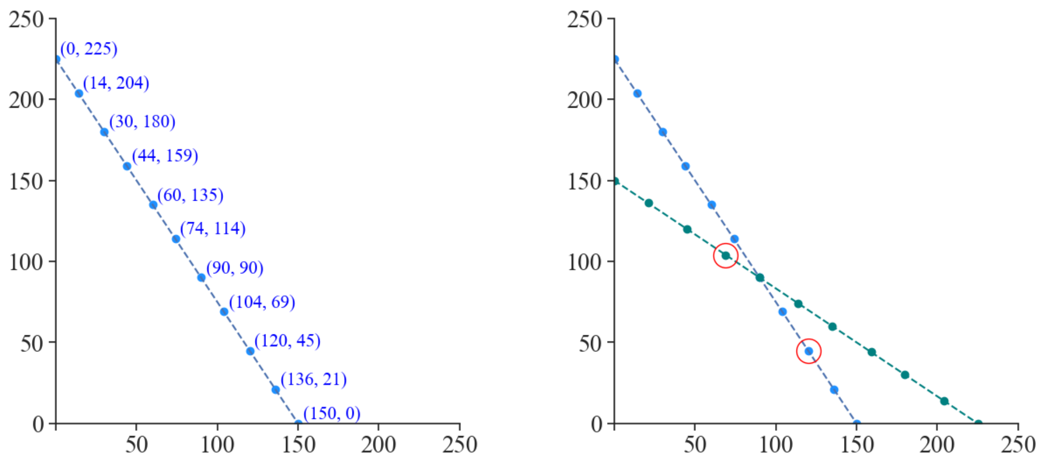
By a theorem of Cosaert and Demuynck (2015), we have that [1] if and only if [3]. Hence in the following proof, I show equivalently that [2] if and only if [3].

[3] implies [2]. Suppose that [3] is true. Define $\gamma(M) = M$ for all $M \in \mathscr{X}$. Given $D = \{c^i, M^i\}_{i=1}^n$, define $E = \{e^i, M^i\}_{i=1}^n$ such that for all i: if $|M^i| \geq 2$, then $e^i = (e^i_1, ..., e^i_{|M^i-1|}, c^i)$ with $\bigcup_{r=1}^{|M^i|}\{e^i_r\} = M^i$; if $|M^i| = 1$, then $e^i = (c^i)$. For all i and $r = 1, ..., |M^i|$, we have $e^i_r \in \gamma(E^i_r)$ (Definition 3 (i)); $c^i \in \{x \in \gamma(E^i_r) | x \succeq e^i_r, x \neq e^i_r\} \neq \emptyset$ if $|E^i_r| \geq 2$ (Definition 3 (ii)); and $c_i = e^i_{|M^i|}$ (Definition 3 (iii)). Thus, D is generated by sequential elimination.

[2] implies [3]. Suppose that [2] is true. Let $\succeq$, γ, and $E = \{e^i, M^i\}_{i=1}^n$ be the preference relation, consideration set mapping, and elimination data set that satisfy the conditions in Definition 3. Suppose by contradiction that there exists some $j \in \{1, ..., n\}$ such that $c^j = e^j_{|M^j|} \notin \{x \in M^j | x \succeq y \; \forall y \in M^j\}$. Since $\succeq$ is complete and transitive, $\{x \in M^j | x \succeq y \; \forall y \in M^j\} \neq \emptyset$. Then there must exist some $r \in \{0, ..., |M^j - 1|\}$ such that $e^j_r \in \{x \in M^j | x \succeq y \; \forall y \in M^j\}$ and $\{x \in E^i_r | x \succeq e^i_r, x \neq e^i_r\} = \emptyset$. This implies $\{x \in \gamma(E^i_r) | x \succeq e^i_r, x \neq e^i_r\} = \emptyset$, which is a contradiction to Definition 3 (ii). Therefore, we have that for all i, $c^i \in \{x \in M^i | x \succeq y \; \forall y \in M^i\}$.

B Details of the Experimental Design

B.1 Decision Problems



(a) A DECISION PROBLEM (b) A GARP VIOLATION

FIGURE B.1. GRAPHICAL ILLUSTRATIONS OF THE DECISION PROBLEMS

Notes: As illustrated in Figure B.1(a), each budget line represents a menu of options in the experiment. Figure B.1(b) shows a pair of choices (indicated by the red circles) in the two decision problems that violate GARP.

B.2 Instructions in the Experiment

B.2.1 Introduction

Welcome to our study on decision-making.

The study consists of three sections. In Section 1, you will make a series of economic decisions. In Section 2, you will participate in some cognitive tasks. In Section 3, you will be asked to imagine yourself in some hypothetical scenarios and answer a few questions related to those scenarios. Detailed instructions will be provided at the beginning of each section.

You will receive £3 as a participation fee for completing the study. You will also earn an additional payment of up to £14.6 depending partly on your decisions and partly on chance. You will be paid within 3 working days after completing the study.

Please pay careful attention to the instructions. During the study, we will speak in terms of experimental tokens instead of pounds. The sum of tokens you earn in the experiment will be converted to pounds at the following rate:

25 tokens= £1

Important: Once you have moved on to the next question, you cannot go back and change your choice. Do not close the web browser at any time!

B.2.2 Experimental Section 1

Section 1 consists of two blocks, Blocks A and B. Each block consists of 21 decision problems that share a common format. An example of the decision problem will be provided at the beginning of each block.

In each decision problem, you will be asked to choose **one** option out of multiple options. An option [X, Y] indicates that you will earn either X tokens or Y tokens with **the same** probability. For instance, the option [24, 32] indicates that you will earn 24 tokens with probability 50% and 32 tokens with probability 50%.

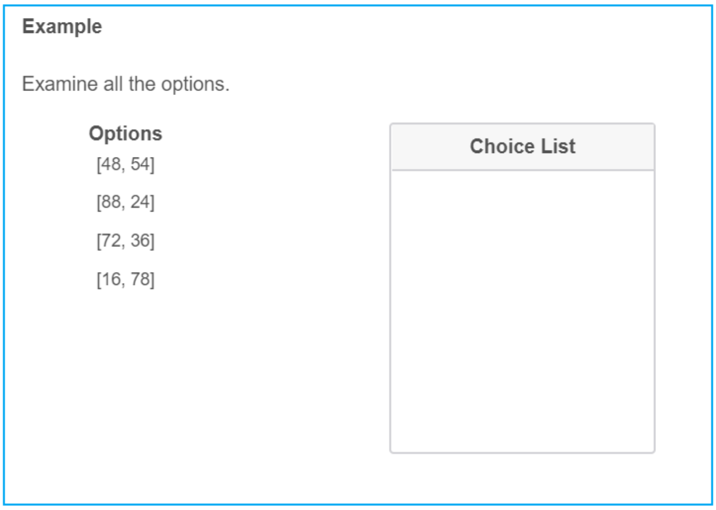
In each decision problem, you are encouraged to examine all options and should choose only one option that you prefer. There is no right and wrong answer to each decision problem. We are interested in studying your preferences.

We use the following method to determine your payment in Section 1: At the end of Section 1, you will be asked to make a choice between Blocks A and B for your payment. At the end of the experiment, one of the 21 problems from the block you choose will be drawn at random. Each problem has **the same** probability of being drawn. You will earn tokens according to your choice in this randomly drawn problem.

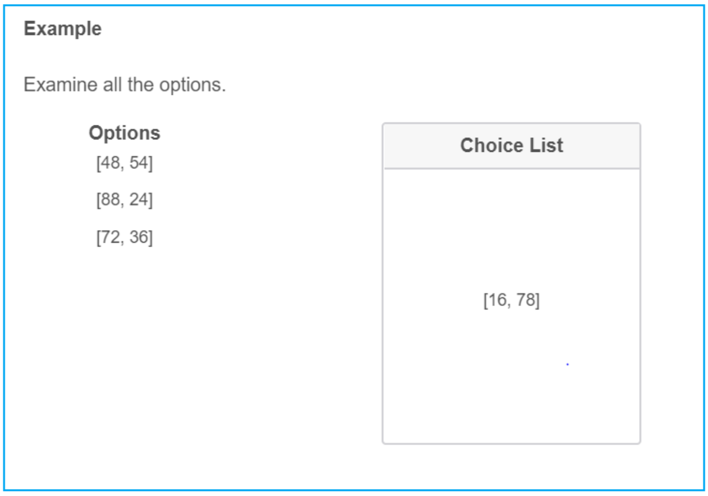
You will earn real money, depending on your decisions. Please make careful decisions.

B.2.2.1 The Direct Procedure (Block A)

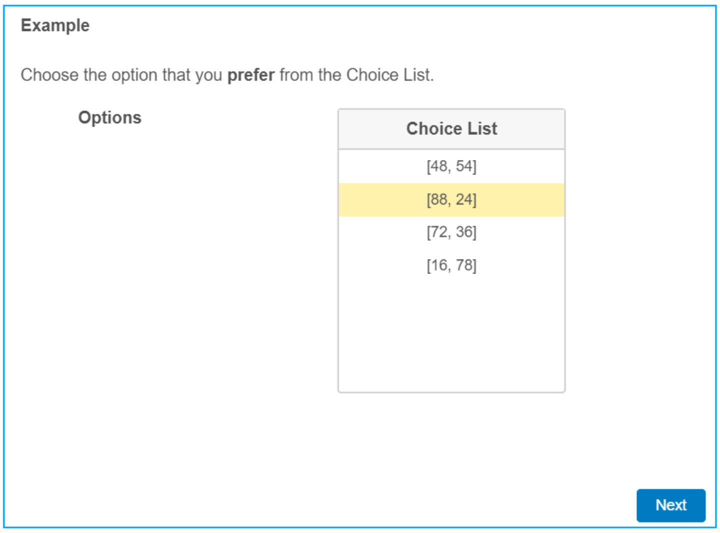
In this block, you will participate in 21 decision problems. You will make decisions by a procedure called "**sequential examination**". You will be asked to sequentially examine, one by one, options by clicking on them. Then you will be asked to choose only **one** option that you **prefer**. Below, you can see an example of sequential examination:



For instance, if you have examined the option [16, 78], you can click on it. It will then be moved to the "**Choice List**".



You should examine all the options by clicking on them. Then you can choose the option that you prefer from the "**Choice List**" by clicking on it. Your final choice will be highlighted in yellow. For instance, in the screen below, your choice is [88, 24].



You should click on “Next” to confirm your choice and proceed to the next problem.

Regarding payment, suppose that you choose [88, 24] by sequential examination. If you are paid according to this choice, you would receive 88 tokens with 50% probability and 24 tokens with 50% probability.

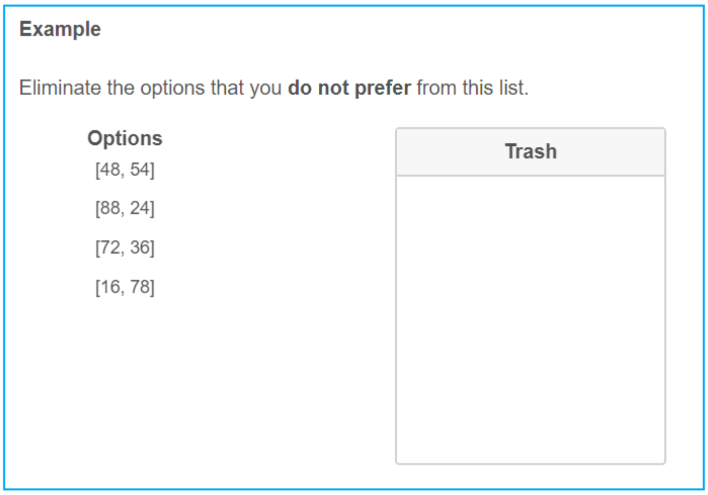
To familiarize you with the decision problems, you will have a practice problem. It will not affect your payment. Then you will be asked to complete all the problems.

Important: Once you have clicked on “**Next**”, you cannot go back and change your choice.

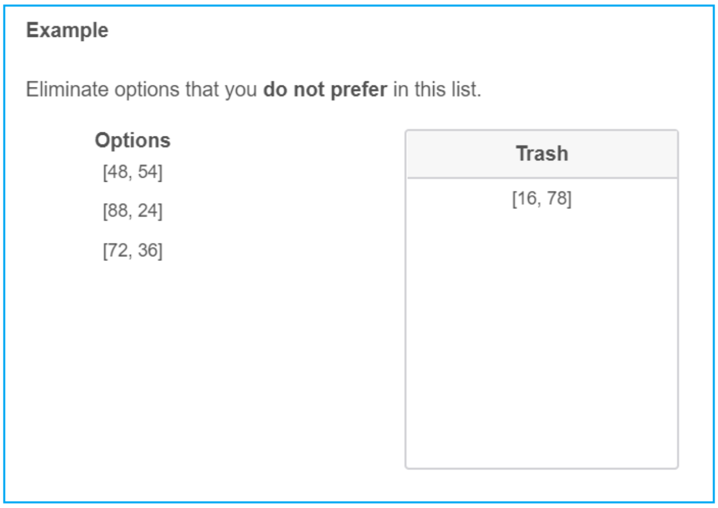
B.2.2.2 Sequential Elimination (Block A)

In this block, you will participate in 21 decision problems. You will make decisions by a procedure called “**sequential elimination**”. You will be asked to sequentially eliminate, one by one, the options that you do not prefer by clicking on them, until only **one** option remains. The **last remaining option** is your **choice** in the decision problem.

Below, you can see an example of sequential elimination:

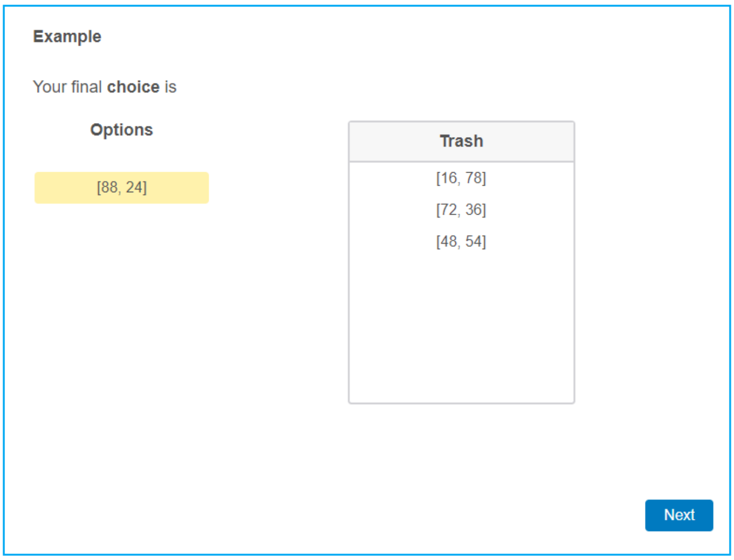


For instance, if you eliminate [16, 78] by clicking on it, it will be moved to the "**Trash**".



Note that you can **recover** the options in the Trash by clicking on them. For example, if you click on [16, 78] in the Trash, it will be moved back to the "Options".

Regarding your choice, you should eliminate options until only **one** option remains. For instance, in the screen below, supposed that you have eliminated [16, 78], [72, 36] and [48, 54]. As a result, the **last remaining** [88, 24] is your final **choice** in this problem. Your final choice is highlighted in yellow.



You should click on "Next" to confirm your choice and proceed to the next problem.

Regarding payment, suppose that you choose [88, 24] by sequential elimination. If you are paid according to this choice, you would receive 88 tokens with 50% probability and 24 tokens with 50% probability.

To familiarize you with the decision problems, you will have a practice problem. It will not affect your payment. Then you will be asked to complete all the problems.

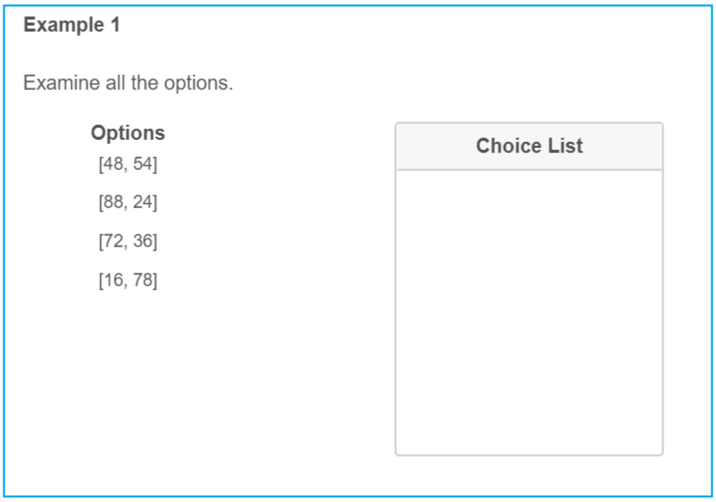
Important: Once you have clicked on "Next", you **cannot** go back and change your choice.

B.2.2.3 The Liberal Procedure (Block A)

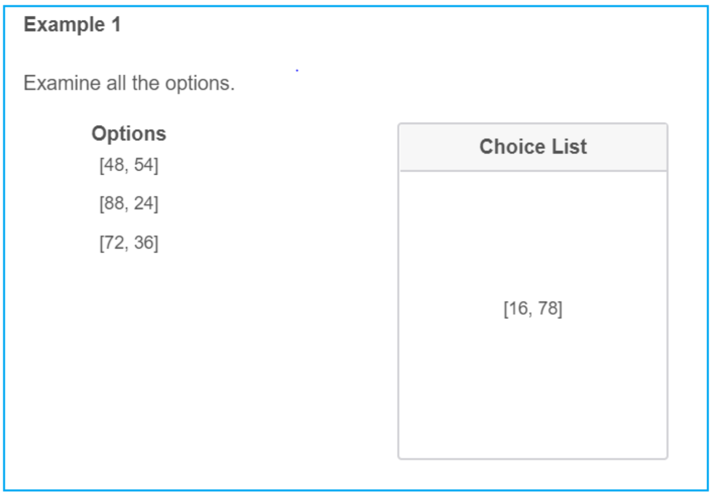
First, you have to make a choice between two choice procedures: sequential examination and sequential elimination. The two procedures will be explained below with examples. Then you will participate in 21 decision problems using the procedure chosen by you.

1) **Sequential Examination**: You will be asked to sequentially examine, one by one, options by clicking on them. Then you will be asked to choose only **one** option that you **prefer**.

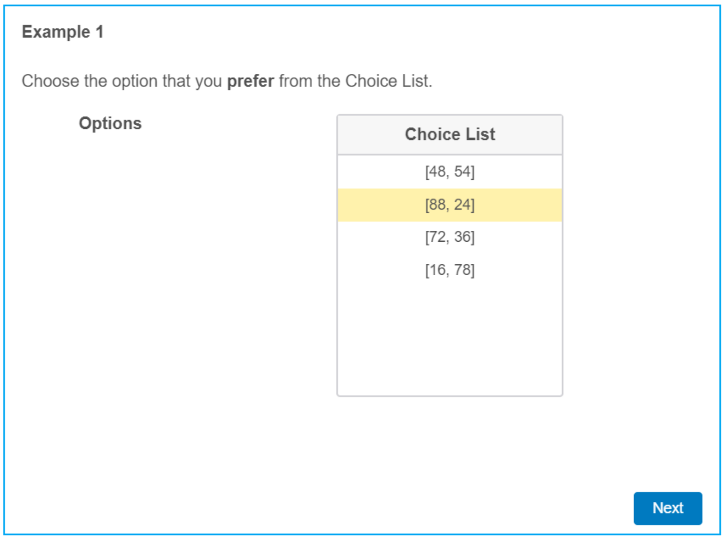
Below, you can see an example of sequential examination:



For instance, if you have examined the option [16, 78], you can click on it. It will then be moved to the "**Choice List**".



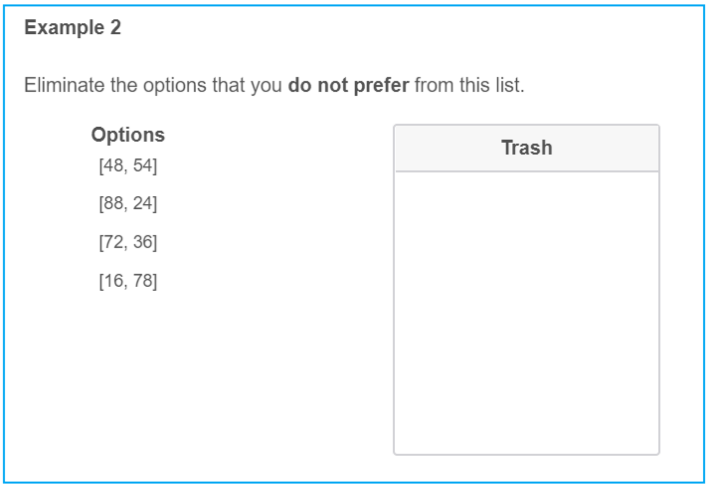
You should examine all the options by clicking on them. Then you can choose the option that you prefer in the "**Choice List**" by clicking on it. Your final choice will be highlighted in yellow. For instance, in the screen below, your choice is [88, 24].



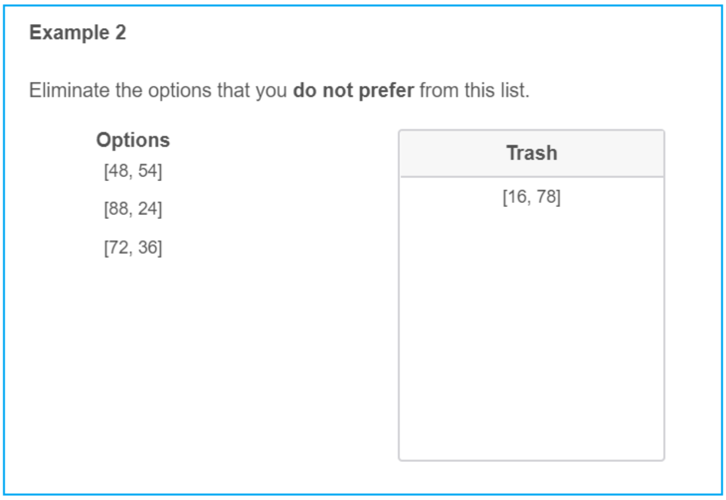
You should click on “Next” to confirm your choice and proceed to the next problem.

2) **Sequential Elimination**: You will be asked to sequentially eliminate, one by one, the options that you do **not prefer** by clicking on them, until only one option remains. The **last remaining option** is your **choice** in the decision problem.

Below, you can see an example of sequential elimination:



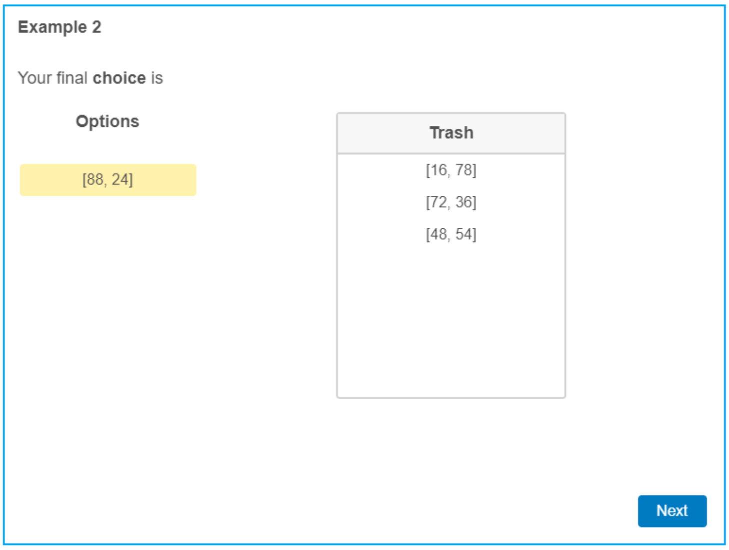
For instance, if you eliminate [16, 78] by clicking on it, it will be moved to the “**Trash**”.



Note that you can **recover** the options in the Trash by clicking on them. For example, if you click on [16, 78] in the Trash, it will be moved back to the "Options".

Regarding your choice, you should eliminate options until only **one** option remains. For instance, in the screen below, supposed that you have eliminated [16, 78], [72, 36] and [48, 54]. As a result, the **last remaining** [88, 24] is your final choice in this problem. Your final **choice** is highlighted in yellow.

You should click on "Next" to confirm your choice and proceed to the next problem.



Regarding payment, suppose that you choose [88, 24] by sequential examination or sequential elimination. If you are paid according to this choice, you would receive 88 tokens with 50% probability and 24 tokens with 50% probability.

To familiarize you with the decision problems, you will have a practice problem for each procedure. It will not affect your payment. Then you will be asked to choose a procedure and complete all the problems.

Important: Once you have clicked on "Next", you **cannot** go back and change your choice.

B.2.2.4 The Liberal Procedure: Procedure Selection

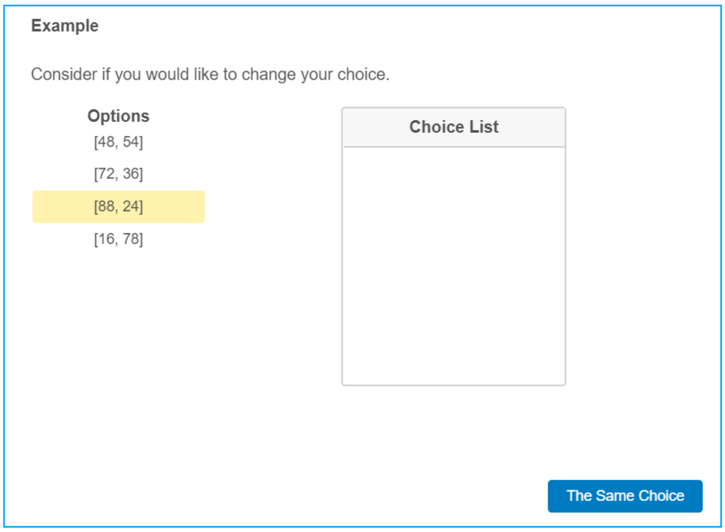
Please indicate which procedure that you would like to use in Section 1.

- The Direct Procedure
- Sequential Elimination

B.2.2.5 The Direct Procedure (Block B)

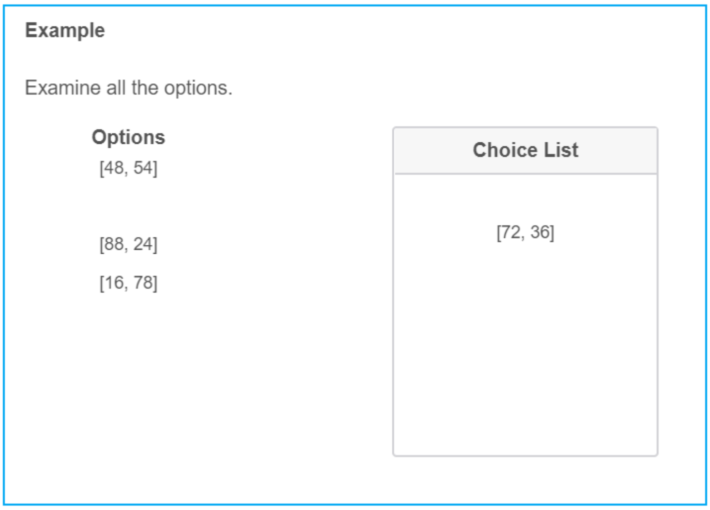
In this block, you will confront the **same** 21 decision problems as those in Block A. You will see your choice from the corresponding problem in Block A highlighted in yellow. You will be asked to consider if you would like to change you choice.

Below, you can see an example of Block B problem:



You can choose the same option as you chose in the corresponding problem in Block A by clicking on "The Same Choice". For instance, if you click on "The Same Choice" in this problem, your choice is [88, 24] and you will proceed to the next problem directly.

If you want to change your choice, you can click on **any** option on the list. Then you can start again the sequential examination. For instance, if you click on [72, 36], you will see the screen below.



Regarding payment, suppose that this time you choose [48, 54]. If you are paid according to this choice, you would receive 48 tokens with 50% probability and 54 tokens with 50% probability.

To familiarize you with the decision problems, you will have a practice problem. It will not affect your payment. Then you will be asked to complete all the problems.

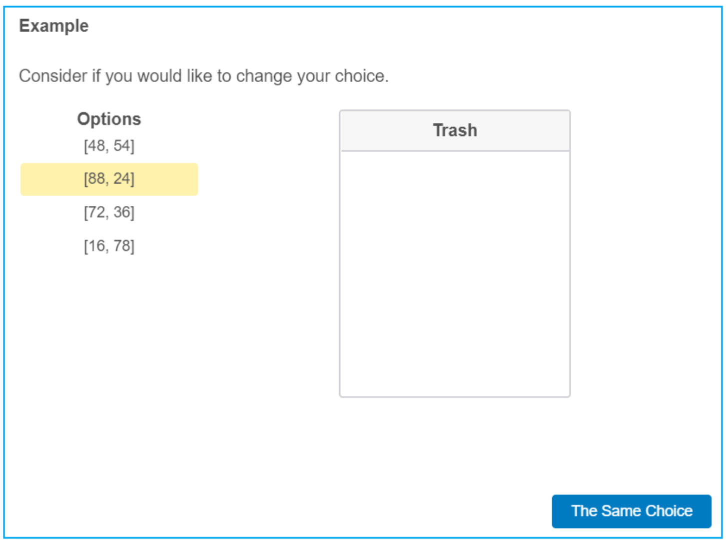
Remember that we will ask you to choose between Blocks A and B for payment at the end of Section 1.

Important: Once you have clicked on “Next”, you **cannot** go back and change your choice.

B.2.2.6 Sequential Elimination (Block B)

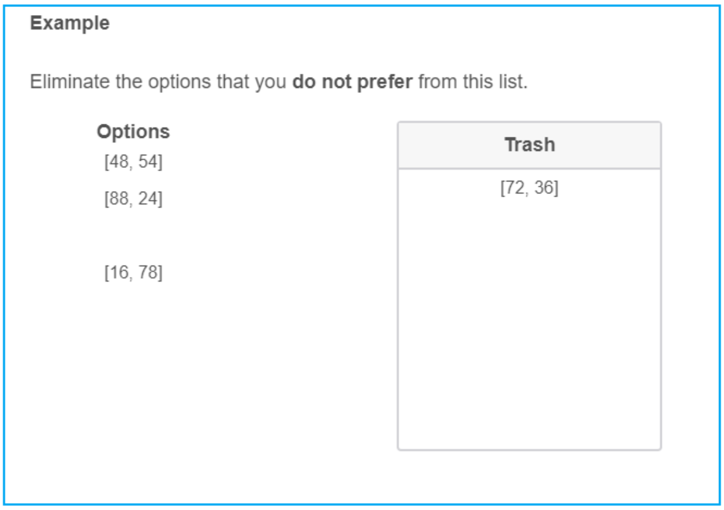
In this block, you will confront the **same** 21 decision problems as those in Block A. You will see your choice from the corresponding problem in Block A highlighted in yellow. You will be asked to consider if you would like to change you choice.

Below, you can see an example of Block B problem:



You can choose the same option as you chose in the corresponding problem in Block A by clicking on “The Same Choice”. For instance, if you click on “The Same Choice” in this problem, your choice is [88, 24] and you will proceed to the next problem directly.

If you want to change your choice, you can click on **any** option on the list. Then you can start again the sequential elimination. For instance, if you click on [72, 36], you will see the screen below.



Regarding payment, suppose that this time you choose [48, 54]. If you are paid according to this choice, you would receive 48 tokens with 50% probability and 54 tokens with 50% probability.

To familiarize you with the decision problems, you will have a practice problem. It will not affect your payment. Then you will be asked to complete all the problems.

Remember that we will ask you to choose between Blocks A and B for payment at the end of Section 1.

Important: Once you have clicked on “Next”, you **cannot** go back and change your choice.

B.2.2.7 Payment Block Selection

Please indicate that which block you would like to choose for your payment in Section 1.

- Block A
- Block B

B.2.2.8 Individual Satisfaction (The Direct Procedure)

Now, we would like to understand how satisfied you are with the decisions you made in Section 1.

A rating of 0 means that you are not satisfied at all. A rating of 10 means that you cannot be more satisfied. Please select the number between 0 and 10 that best describes how you feel about the sequential examination procedure and your choices in Section 1.

How satisfied are you with the **sequential examination** procedure in Section 1?

0 1 2 3 4 5 6 7 8 9 10

Satisfaction with the sequential examination

How satisfied are you with **your choices** in Section 1?

0 1 2 3 4 5 6 7 8 9 10

Satisfaction with your choices:

B.2.2.9 Individual Satisfaction (Sequential Elimination)

Now, we would like to understand how satisfied you are with the decisions you made in Section 1.

A rating of 0 means that you are not satisfied at all. A rating of 10 means that you cannot be more satisfied. Please select the number between 0 and 10 that best describes how you feel about the sequential elimination procedure and your choices in Section 1.

How satisfied are you with the the **sequential elimination** procedure in Section 1?

0 1 2 3 4 5 6 7 8 9 10

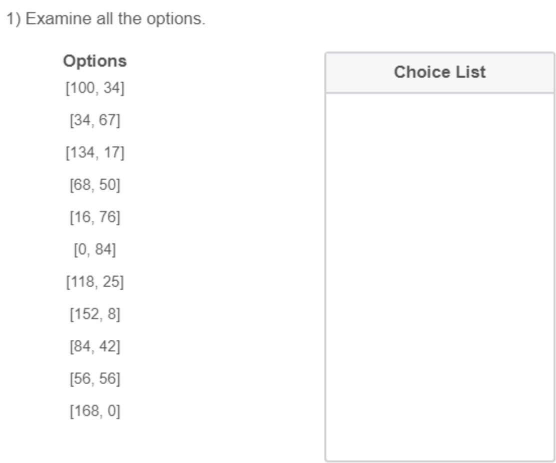
Satisfaction with the sequential elimination

How satisfied are you with **your choices** in Section 1?

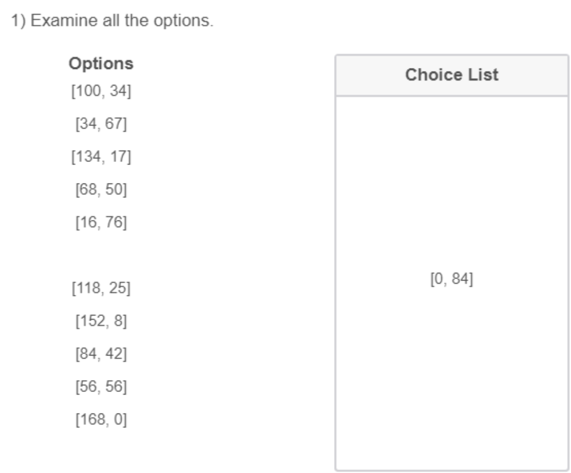
0 1 2 3 4 5 6 7 8 9 10

Satisfaction with your choices:

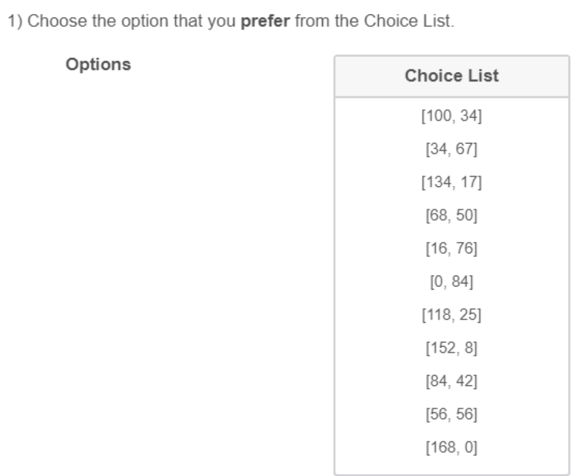
B.2.2.10 Screenshots of the Treatments



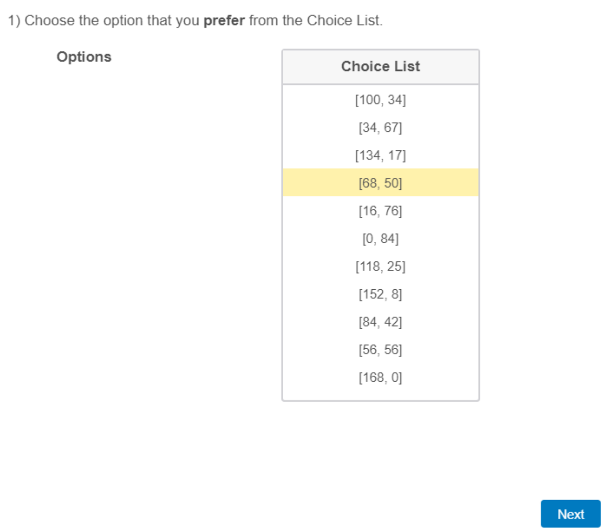
(a) INITIAL SCREEN



(b) AN OPTION IS EXAMINED

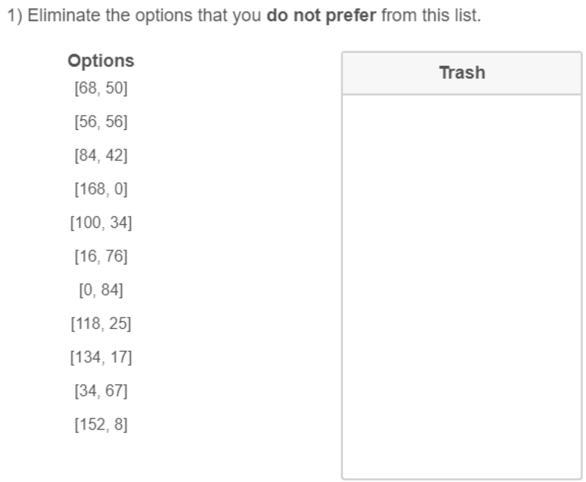


(c) ALL OPTIONS ARE EXAMINED

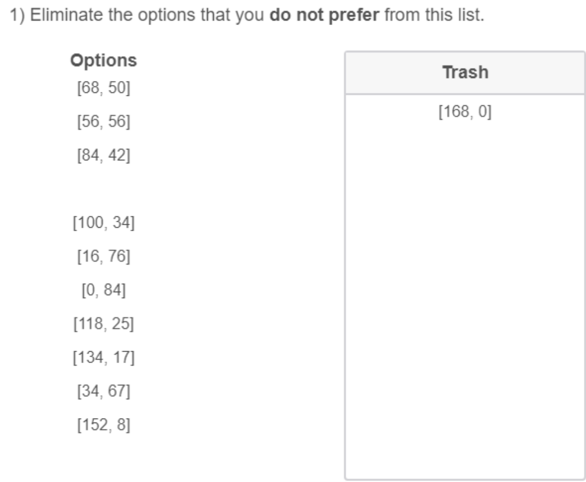


(d) MAKING A CHOICE

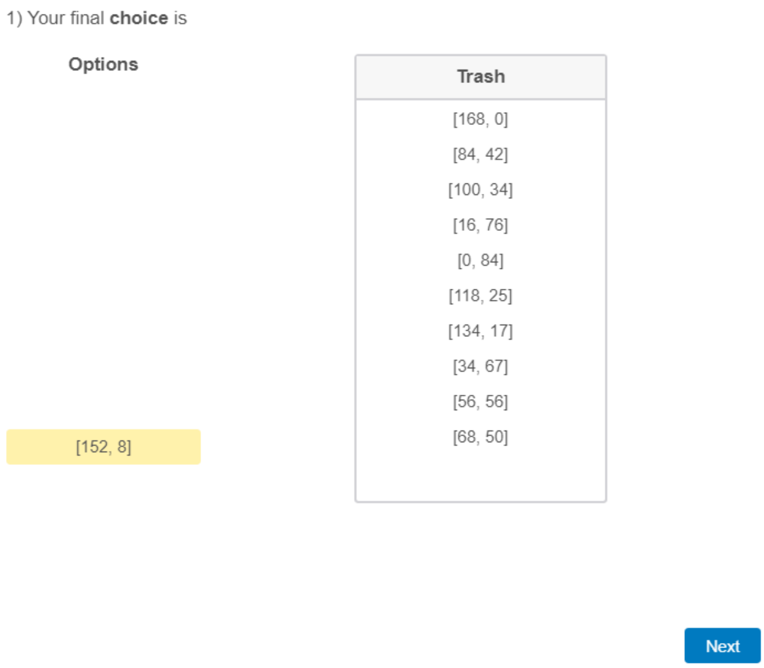
FIGURE B.2. THE DIRECT PROCEDURE



(a) INITIAL SCREEN



(b) AN OPTION IS ELIMINATED



(c) MAKING A CHOICE

FIGURE B.3. SEQUENTIAL ELIMINATION

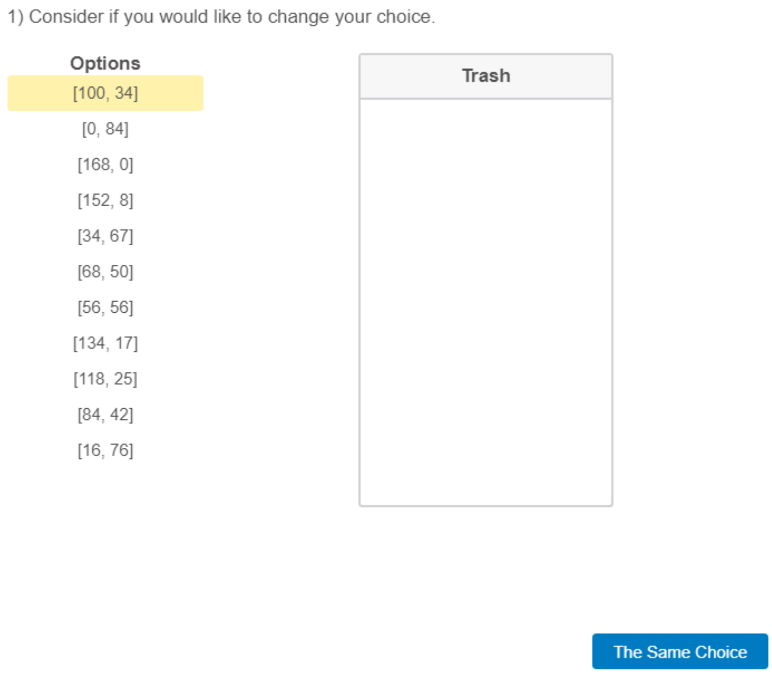


FIGURE B.4. CHOICE REVISION

B.2.3 Experimental Section 2

This section has three cognitive tasks. Your payment in this section will depend on your performance in the three tasks. Each task has a different number of questions. At the end of the experiment, the computer will randomly draw three questions from all the tasks with equal probability. For each correct answer to the random three questions, you will receive 25 tokens.

B.2.3.1 Task 1: International Cognitive Ability Resource (ICAR) Test

In this task, you are asked to answer ten questions. Five of them are about matrix reasoning and the other five are about three-dimensional rotation. There is a right answer to each question. You can have at most twelve minutes in this task.

Please indicate which is the best answer to complete the figure below.

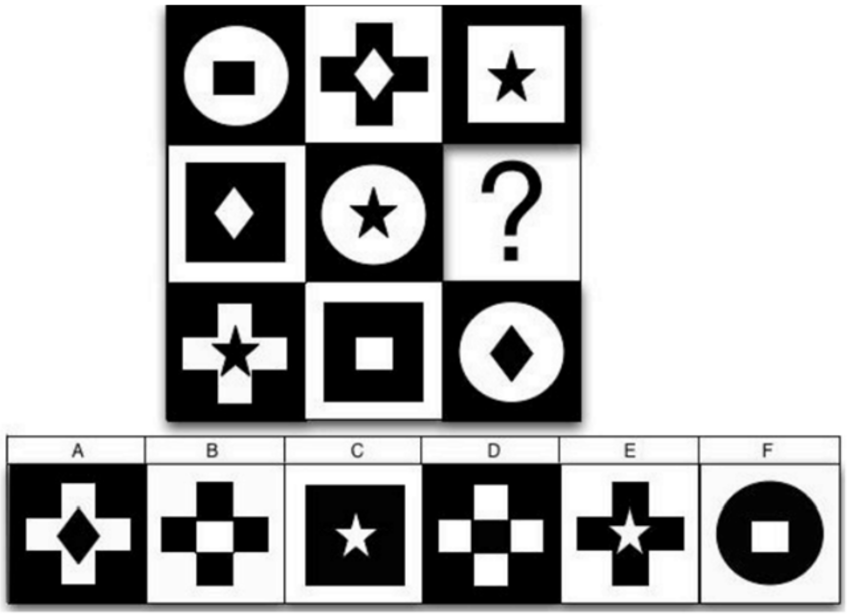


FIGURE B.5. ICAR, MATRIX REASONING PROBLEM

Please indicate which is the best answer to complete the figure below.

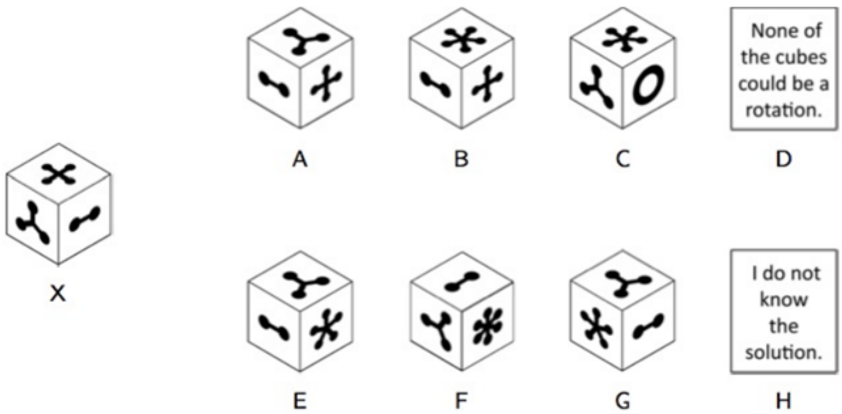


FIGURE B.6. ICAR, THREE-DIMENSIONAL ROTATION PROBLEM

B.2.3.2 Task 2: Stroop Task

This task measures your concentration. In each round, you are asked to **identify the color of the word shown on the screen**. The word itself is irrelevant — you can safely ignore it. To indicate the color of the word, please use the keys **r**, **g**, **b** and **o** for red, green, blue and orange, respectively. A plus sign will be shown before each word, please keep your eyes on the plus sign. You will have only two seconds in each round.

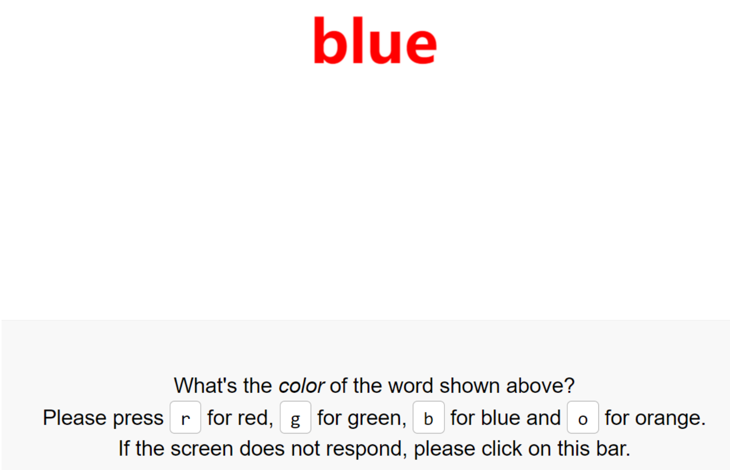
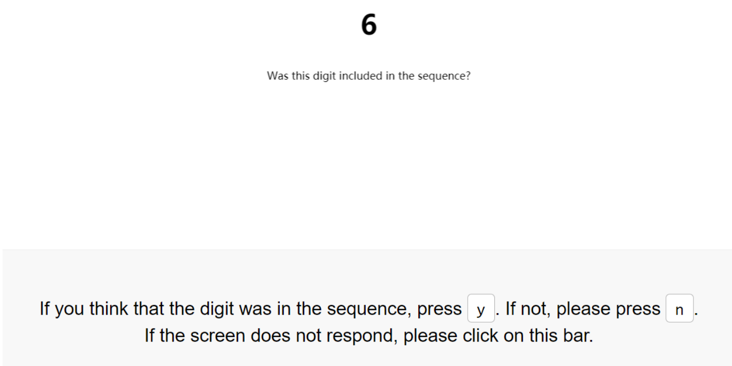


FIGURE B.7. STROOP TASK

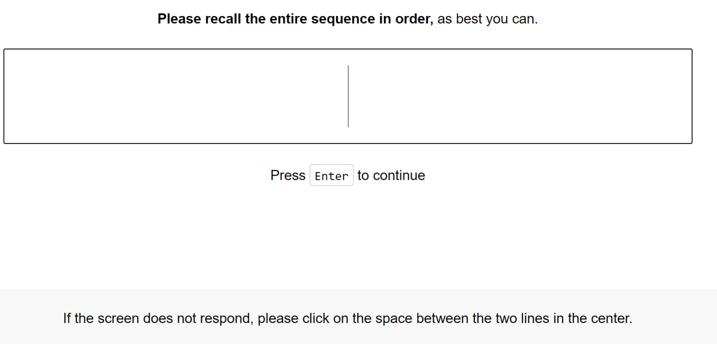
B.2.3.3 Task 3: Sternberg Task

This task measures your working memory. In each round, you are asked to memorize a sequence of digits. The length of this sequence can vary from four to eight digits. After the presentation, we will ask you to indicate whether a certain digit was included in the sequence. Please press **y** if you think that the digit was in the sequence. If not, please press **n**. If your decision is correct, you will see a green circle. Otherwise, you will see a red circle. Then we will ask you to type in the entire sequence.

(a) MEMORIZATION PHASE



(b) RECALL PHASE 1



(c) RECALL PHASE 2

FIGURE B.8. STERNBEG TASK

B.2.4 Experimental Section 3

In this section, you will also be asked to imagine yourself in three hypothetical scenarios and answer a few questions related to those scenarios. There are no right or wrong answers to those questions, simply answer based on your feeling.

B.2.4.1 Attitude toward Inconsistency

Imagine that you are at a cinema and wish to buy some popcorn. The cinema sells small tubs of popcorn for £3 and large ones for £7. Suppose that you choose the small one. Now consider a different situation. The cinema sells small tubs for £3, medium ones for £6.50 and large ones for £7. This time you choose the large one.

In the first case, you prefer the small size to the large. In the second case, your choice suggests the opposite. How at ease do you feel with your choices? Please rate how at ease you feel on the scale provided. A rating of 0 means that you are not at all at ease with one or more of your choices and would really like to make changes. A rating of 10 means that you could not be more at ease and have no wish to change anything.

B.2.4.2 Sunk Cost Fallacy

Imagine that you have spent £50 on a ticket for concert A and £100 on a ticket for concert B. You really prefer A to B, but you have discovered that the two concerts are to take place exactly at the same time on the same day. You cannot obtain a refund or sell the tickets. Which concert would you go to?

- Concert A
- Concert B

B.2.4.3 Non-Consequentialism

Imagine two trips you may make this summer. You plan Trip 1 by yourself. Someone plans Trip 2 for you. The plans for both trips are the same. You will visit the same places, take the same photos and enjoy the same foods. In other words, you will enjoy the same experiences on both trips. Which trip do you prefer to go to?

- Trip 1
- Trip 2
- I am indifferent between the two trips.

C Descriptive Statistics of the Sample

C.1 Demographics

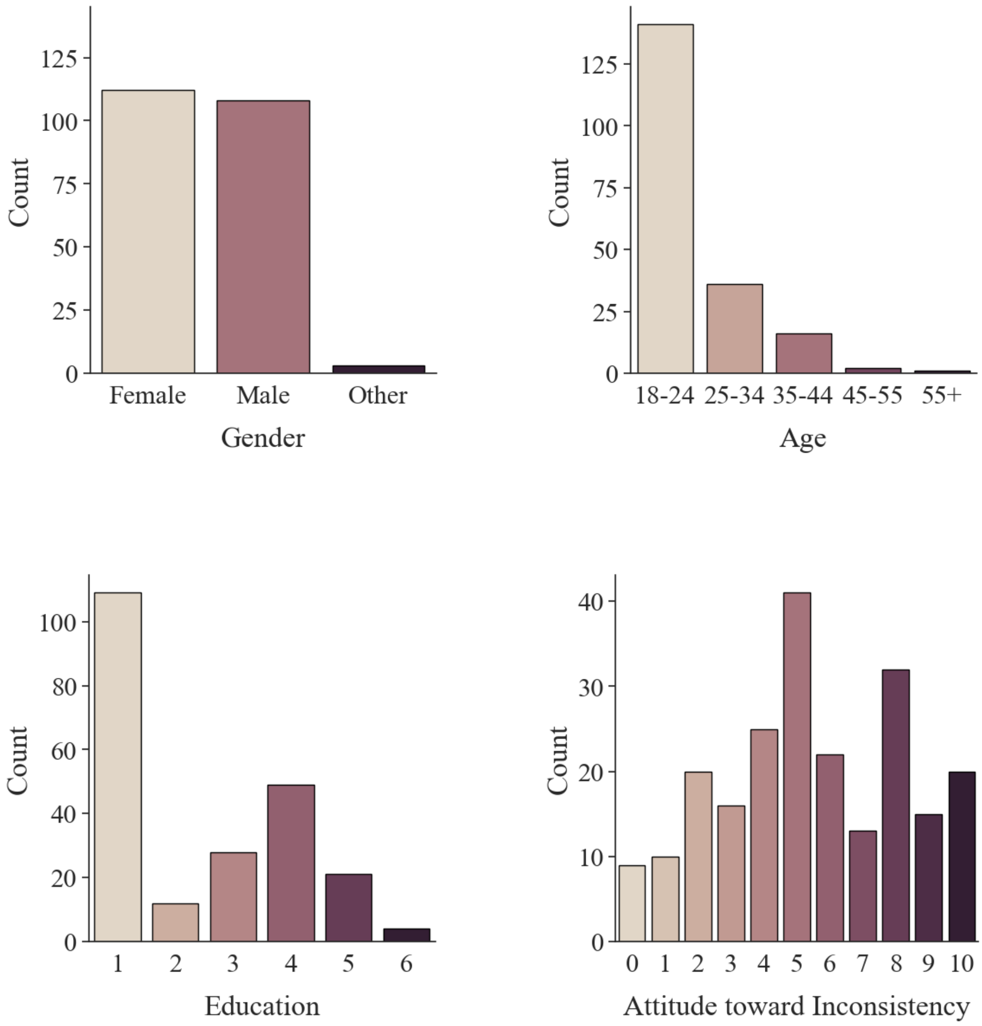


FIGURE C.1. HISTOGRAMS OF DEMOGRAPHICS

Notes: The variable *education* takes a numeric value defined as follows: 0="No Qualifications", 1="High school diploma/A-levels" or "Secondary education (e.g., GED/GCSE)", 2="Technical/community college", 3="Undergraduate degree (BA/BSc/other)", 4="Graduate degree (MA/MSc/MPhil/other)", 5="Doctorate degree (PhD/other)".

C.2 Cognitive Ability

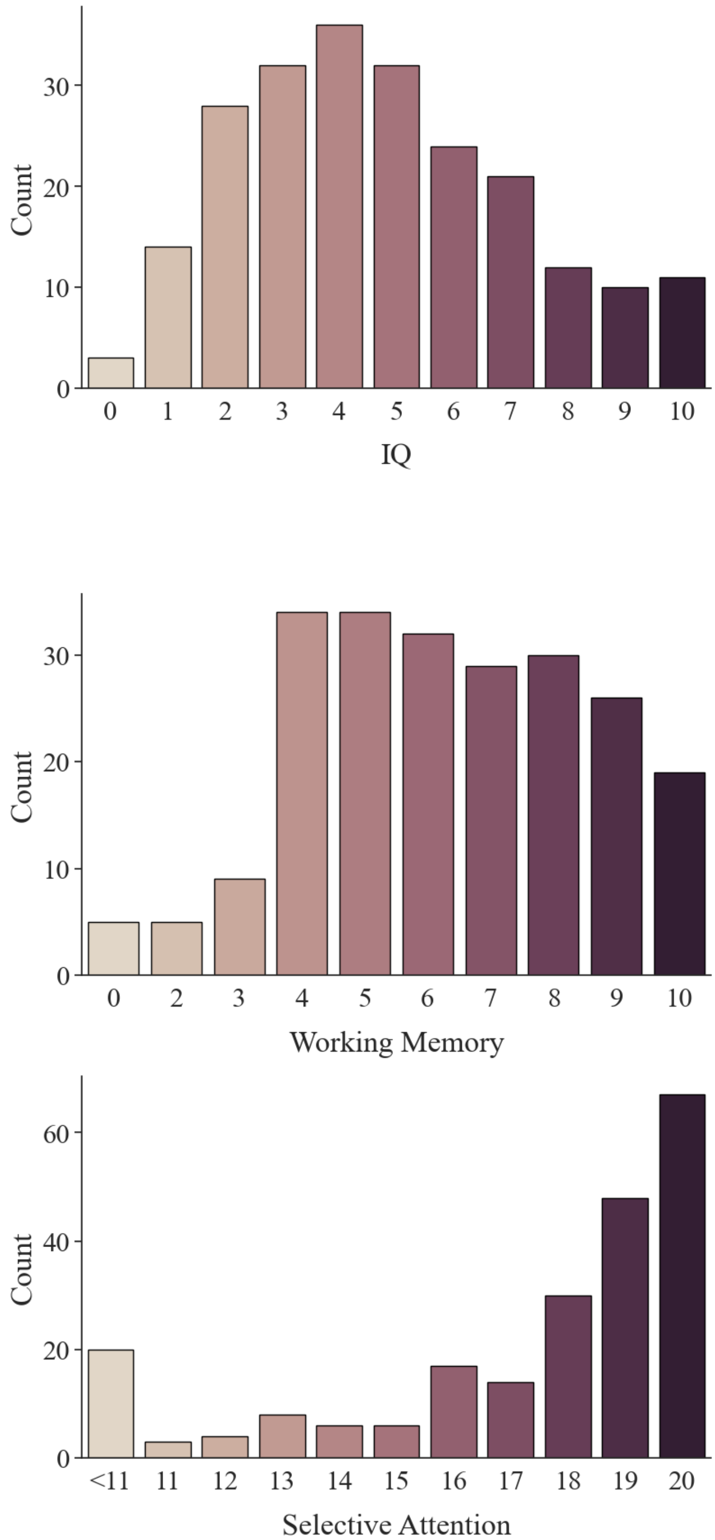


FIGURE C.2. HISTOGRAMS OF COGNITIVE ABILITY

C.3 Balance Checks

TABLE C.1. DESCRIPTIVE STATISTICS AND BALANCE

Variable	Direct Procedure (1)	Sequential Elimination (2)	Difference (3)
Age	23.1	24.7	1.6
	(5.1)	(8.3)	(1.1)
Female	0.5	0.5	-0.0
	(0.5)	(0.5)	(0.1)
Education	2.0	2.0	0.0
	(1.2)	(1.2)	(0.2)
IQ	4.9	4.6	-0.3
	(2.3)	(2.6)	(0.4)
Selective Attention	17.2	16.6	-0.6
	(3.4)	(4.2)	(0.6)
Working Memory	6.2	6.1	-0.1
	(2.2)	(2.3)	(0.4)
Attitude toward inconsistency	5.8	5.3	-0.5
	(2.9)	(2.9)	(0.5)
Observations	75	73	148

Notes: Columns 1 and 2 report standard deviations in parentheses; Column 3 reports standard errors in parentheses.

TABLE C.2. DETAILED BREAKDOWN OF OBSERVATIONS

IQ Group \ Procedure	Direct Procedure	Sequential Elimination	Liberal-Direct Procedure	Liberal-Sequential Elimination
Low-IQ subjects	34 (45.3%)	40 (54.8%)	7 (26.9%)	32 (65.3%)
High-IQ subjects	41 (54.7%)	33 (45.2%)	19 (73.1%)	17 (34.7%)
Total	75 (100%)	73 (100%)	26 (100%)	49 (100%)

C.4 Economic Rationality

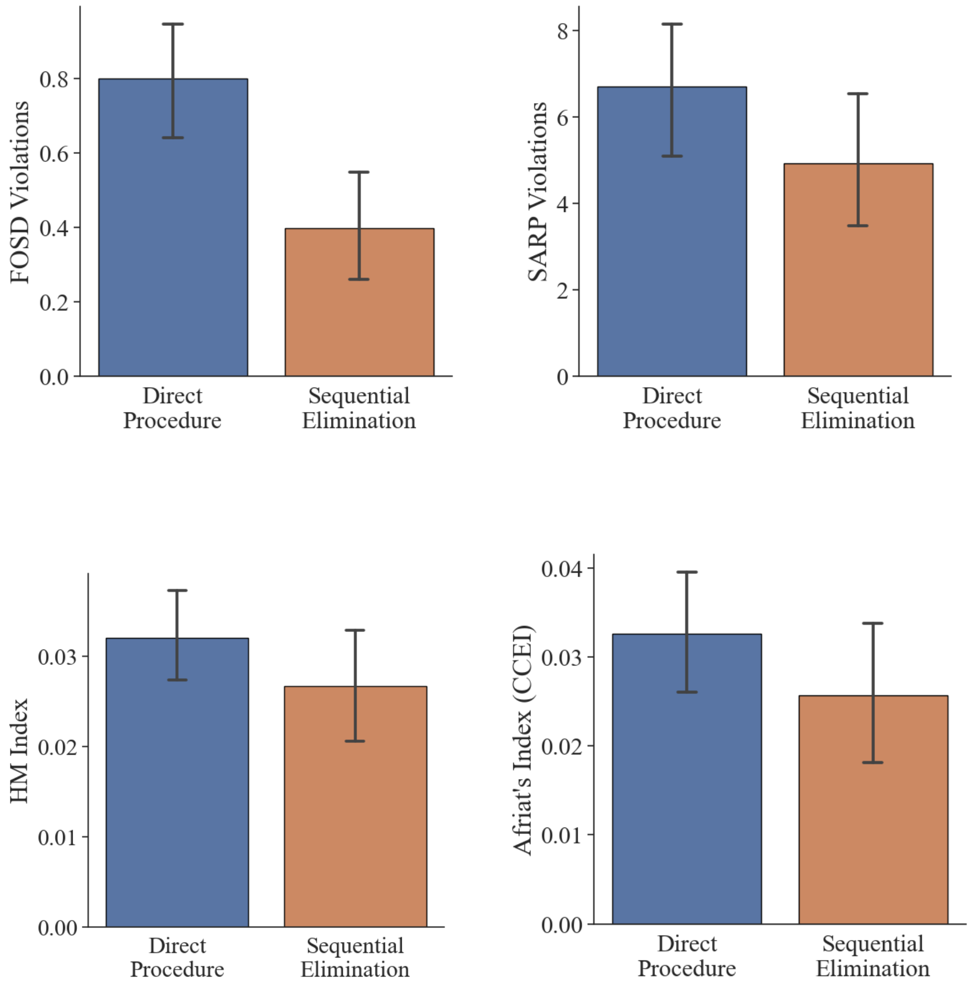


FIGURE C.3. GROUP-BY-GROUP MEANS OF ECONOMIC RATIONALITY MEASURES

Notes: Error bars indicate the standard error of means.

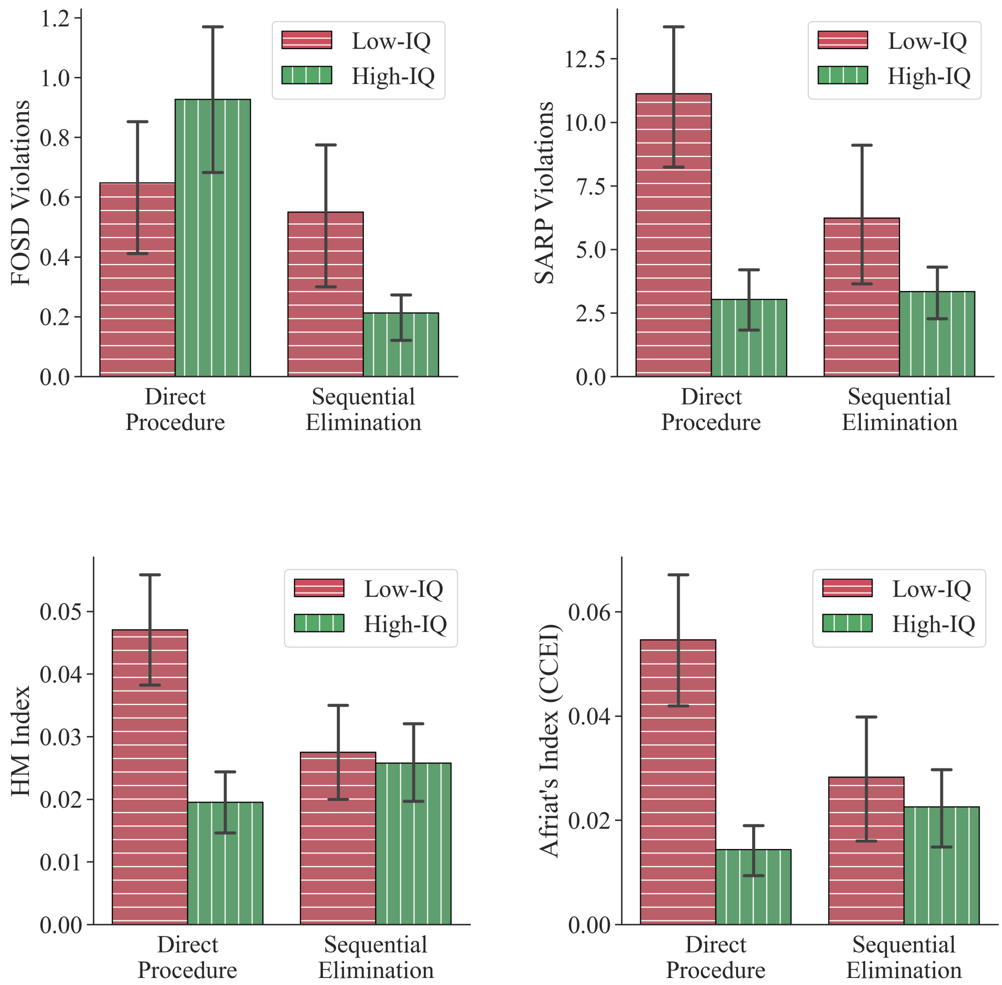


FIGURE C.3 (Continued). GROUP-BY-GROUP MEANS OF ECONOMIC RATIONALITY MEASURES

Notes: Error bars indicate the standard error of means.

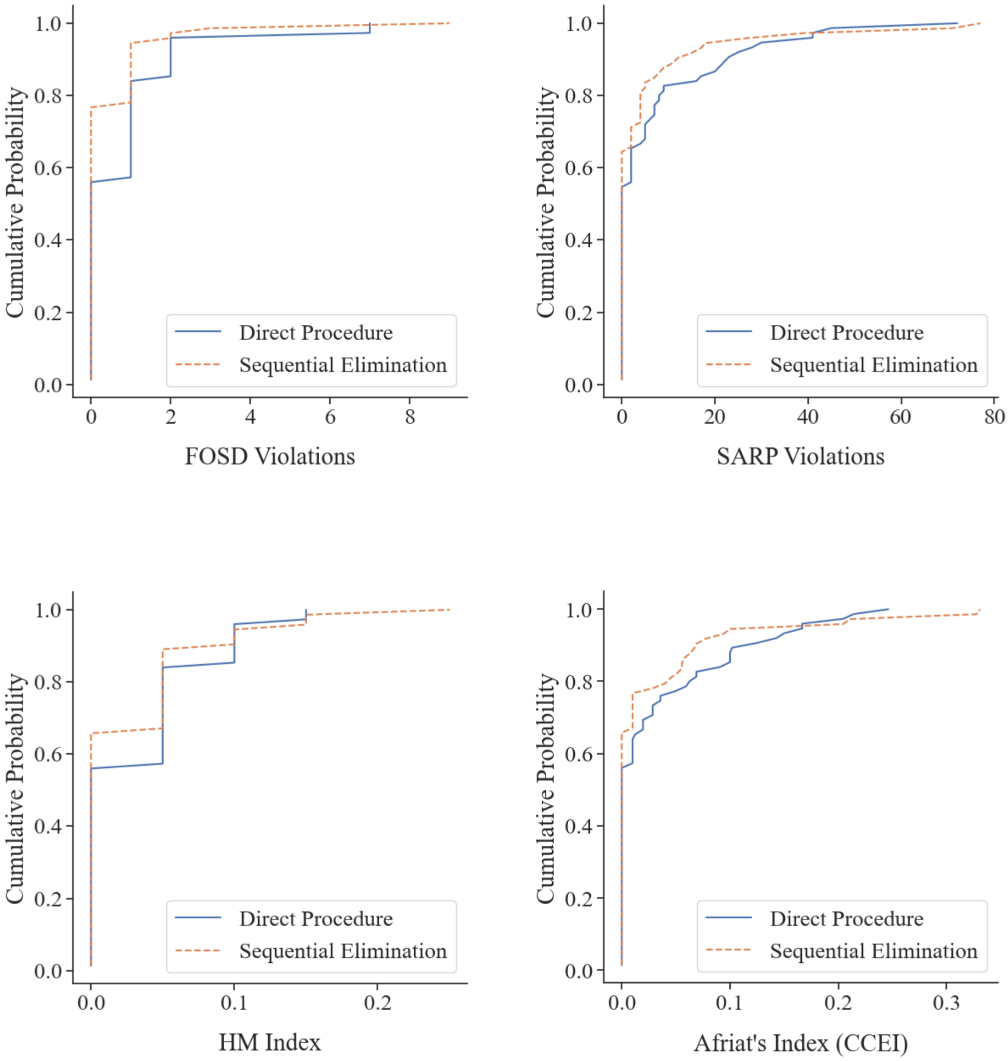
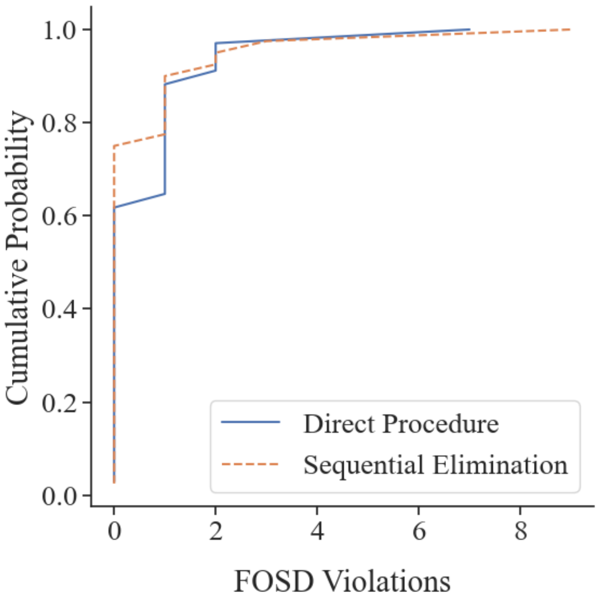
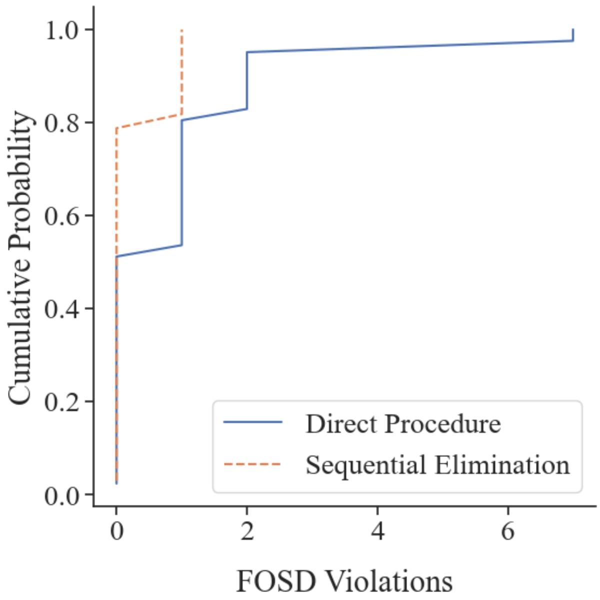


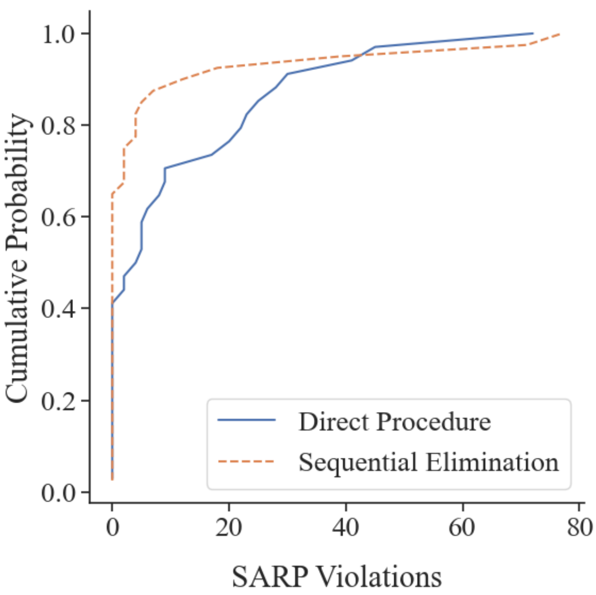
FIGURE C.4. GROUP-BY-GROUP EMPIRICAL CUMULATIVE DISTRIBUTION FUNCTIONS OF ECONOMIC RATIONALITY MEASURES



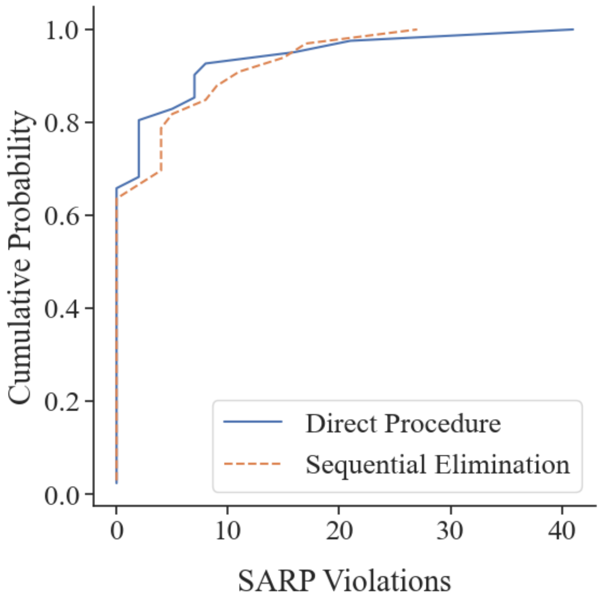
(a) LOW-IQ SUBJECTS



(b) HIGH-IQ SUBJECTS

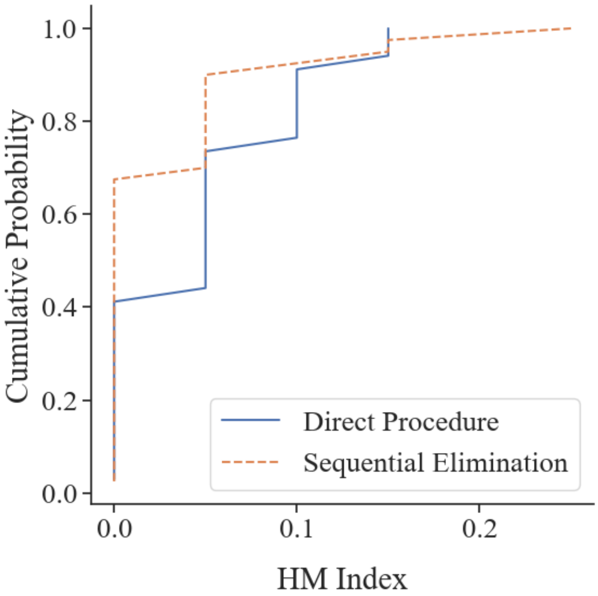


(c) LOW-IQ SUBJECTS

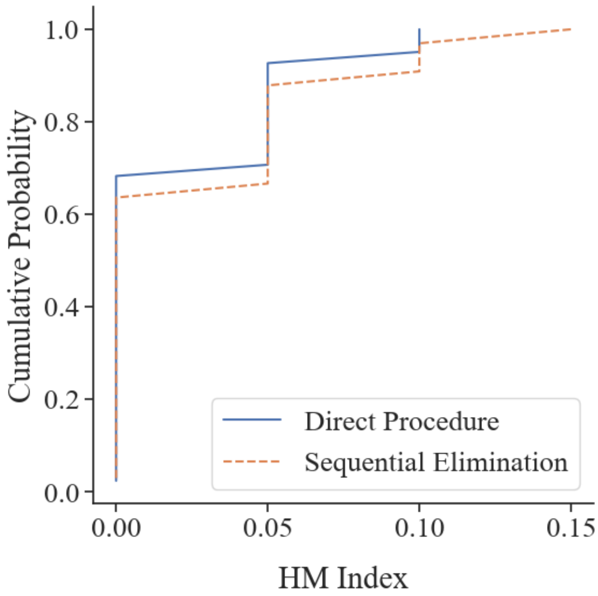


(d) HIGH-IQ SUBJECTS

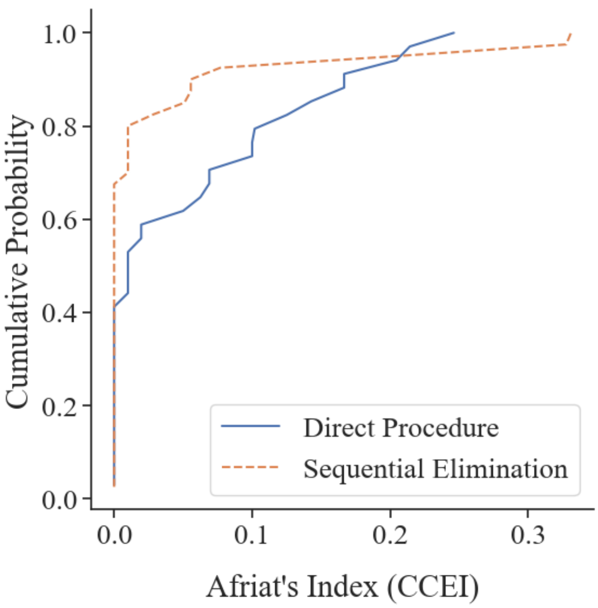
FIGURE C.4 (Continued). GROUP-BY-GROUP EMPIRICAL CUMULATIVE DISTRIBUTION FUNCTIONS OF ECONOMIC RATIONALITY MEASURES



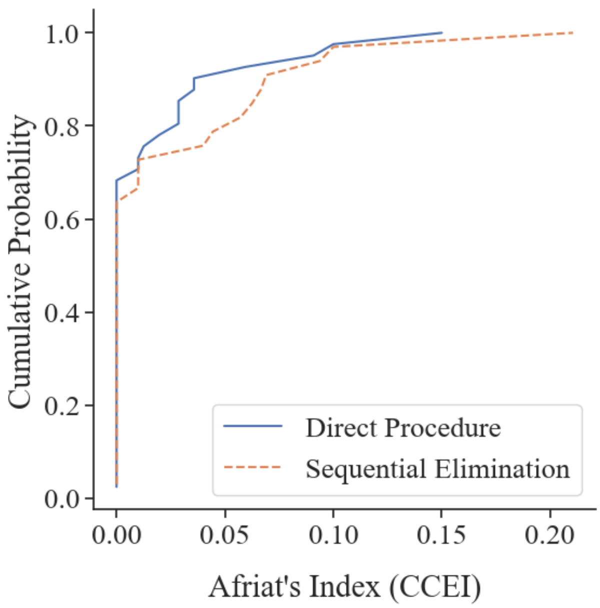
(a) LOW-IQ SUBJECTS



(b) HIGH-IQ SUBJECTS



(c) LOW-IQ SUBJECTS



(d) HIGH-IQ SUBJECTS

FIGURE C.4 (Continued). GROUP-BY-GROUP EMPIRICAL CUMULATIVE DISTRIBUTION FUNCTIONS OF ECONOMIC RATIONALITY MEASURES

D Robustness Checks and Further Analysis

D.1 Economic Rationality

The main results are robust to several alternative approaches. Table D.1 reports the robustness of the results to some alternative specifications. Column 1 of Table D.1 replicates Column 1 of Table 2 but includes the interaction between Sequential Elimination and the numeric variable IQ instead of the categorical variable high-IQ. The effect of Sequential Elimination persists in this specification, corresponding to a reduction in GARP violations by roughly 5.51 at the margin of statistical significance ($p = 0.09$). Columns 2 and 3 replicate again the aforementioned estimation where subjects are categorized by IQ scores based on their positions in the distribution, first by terciles and then by quartiles. I find that Sequential Elimination reduces GARP violations among subjects with IQ scores in the lowest tercile and in the lowest quartile substantially by almost 9.96 ($p = 0.04$) and 8.87 ($p = 0.03$), respectively.

Table D.2 presents the negative binomial regression estimates for SARP violations and the HM index, given their count data nature. Also shown are the OLS regression estimates for the CCEI, where the OLS coefficients exactly reproduce the marginal effects. The first column indicates that the effect of sequential elimination on SARP violations remains meaningful ($p = 0.08$), particularly among low-IQ subjects ($p = 0.04$). Moreover, Columns 2 and 3 show that the effects for low-IQ subjects based on HM index ($p = 0.10$) and CCEI ($p = 0.14$) are approaching conventional levels of statistical significance.

I continue to conduct nonparametric testing of the difference in economic rationality between the Direct Procedure and Sequential Elimination by two-sample permutation tests. 10,000 data sets are generated by randomly shuffling the treatment assignments in the sample, and a calculation is made of the total Variation Distance (TVD) in the distributions of GARP and FOSD violations between the two treatments under these assignments. The null hypothesis is that the economic rationality of choices under the Direct Procedure and Sequential Elimination come from the same distribution. If the null hypothesis is true, the TVD given by the actual data should appear with a high probability in the shuffled data sets; otherwise, it should appear with a low probability. Figure D.1(a) and (b) plot the empirical distributions of the TVDs for GARP and FOSD violations, respectively, in the permutations, which suggest a rejection of the null hypothesis, since the observed TVD data based on the experiment sample (indicated by red lines) are statistically significant ($p < 0.01$ for both).

Moreover, the TVD in the distributions of GARP violations between the Direct Procedure and Sequential Elimination is statistically significant for low-IQ subjects ($p < 0.01$, Figure D.1 (c)) but not for High-IQ subjects ($p = 0.13$, Figure D.1 (e)). Reversely, with the switch from Direct Procedure to Sequential Elimination, the TVD in the distributions of FOSD violations between the treatments is statistically

TABLE D.1. DETERMINANTS OF ECONOMIC RATIONALITY (ROBUSTNESS CHECKS, AVERAGE MARGINAL EFFECTS)

	GARP violations		
	(1)	(2)	(3)
Sequential Elimination	-5.509*	-3.416*	-3.320*
	(4.117)	(2.648)	(2.554)
–1st IQ quartile subjects		-9.955**	-8.871**
		(5.656)	(4.762)
–2nd IQ quartile subjects		-2.234	-5.739
		(4.398)	(9.063)
–3rd IQ quartile subjects		1.668	-0.257
		(1.245)	(1.864)
–4th IQ quartile subjects			2.208
			(1.529)
IQ	-2.807		
	(1.727)		
2nd IQ quartile		0.413	5.121
		(3.546)	(4.844)
3rd IQ quartile		-6.078**	-4.308
		(3.091)	(2.755)
4th IQ quartile			-5.850**
			(2.746)
Selective attention	-0.483	-0.173	-0.196
	(0.477)	(0.286)	(0.301)
Working memory	-0.443	-0.257	0.0461
	(0.648)	(0.449)	(0.426)
Age	-0.325	-0.275	-0.337
	(0.292)	(0.251)	(0.251)
Female	1.435	-0.653	0.587
	(2.488)	(2.145)	(1.926)
Education	-0.854	-1.135	-1.373
	(1.314)	(1.136)	(1.170)
Response time (minutes)	-0.709**	-0.486**	-0.421**
	(0.355)	(0.201)	(0.191)
Attitude toward inconsistency	-0.690	-0.775*	-0.588
	(0.573)	(0.471)	(0.441)
N	148	148	148

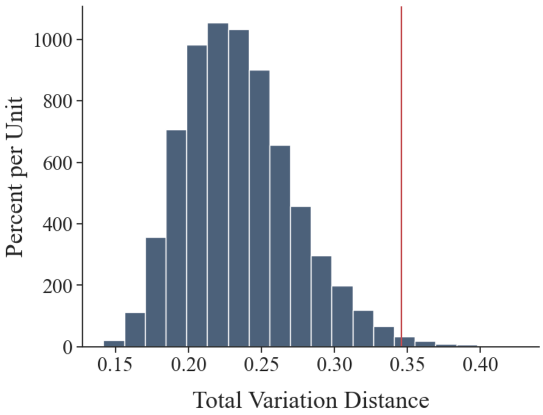
Notes: This table reports the average marginal effects resulting from negative binomial regression analyses of GARP violations using different specifications of IQ. The 1st IQ quartile subjects in the specifications of (2) and (3) are those with the least IQ scores. Robust standard errors are reported in parentheses. Reported p-values for the tests of Sequential Elimination's effects on GARP violations overall and for the 1st IQ quartile subjects are based on one-tailed hypothesis tests. All other significance levels are based upon two-tailed hypothesis tests. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

TABLE D.2. DETERMINANTS OF ECONOMIC RATIONALITY

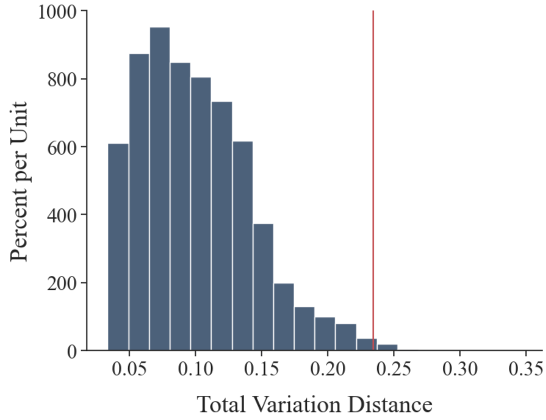
	SARP violations (1)	HM index (2)	CCEI (3)
Sequential Elimination	-4.100*	-0.003	-0.003
	(2.871)	(0.007)	(0.011)
-Low-IQ subjects	-8.762**	-0.014	-0.020
	(4.962)	(0.011)	(0.019)
-High-IQ subjects	0.833	0.008	0.014
	(1.532)	(0.008)	(0.010)
High-IQ	-6.994***	-0.012*	-0.021**
	(2.711)	(0.007)	(0.010)
Selective Attention	-0.266	-0.001	-0.003
	(0.348)	(0.001)	(0.002)
Working Memory	-0.382	-0.003	-0.001
	(0.503)	(0.002)	(0.003)
Age	-0.423*	-0.002**	-0.001**
	(0.242)	(0.001)	(0.001)
Female	-0.154	-0.005	0.003
	(2.079)	(0.007)	(0.009)
Education	-0.936	0.002	-0.000
	(1.287)	(0.004)	(0.004)
Response time (minutes)	-0.442**	-0.001*	-0.002*
	(0.217)	(0.001)	(0.001)
Attitude toward inconsistency	-0.815*	-0.001	-0.002
	(0.478)	(0.001)	(0.002)
N	148	148	148

Notes: This table reports the average marginal effects resulting from negative binomial regression analyses of SARP violations and the HM index, as well as an OLS regression analysis of the CCEI. Robust standard errors are reported in parentheses. Reported p-values for the tests of Sequential Elimination's effects on these consistency measures overall and for low-IQ subjects are based on one-tailed hypothesis tests. All other significance levels are based upon two-tailed hypothesis tests. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

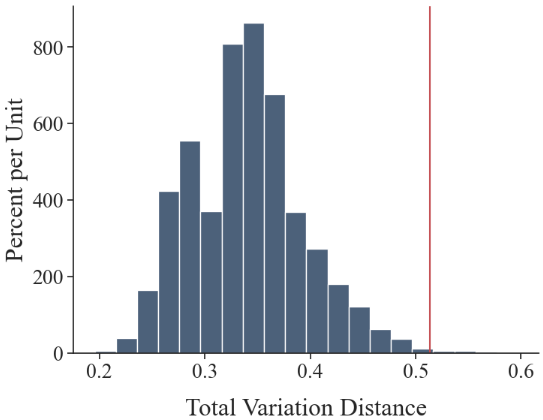
significant for high-IQ subjects ($p = 0.03$, Figure D.1 (f)) but not for low-IQ subjects ($p = 0.24$, Figure D.1 (d)). In sum, the nonparametric test results are highly consistent with the conclusions from the regression analysis.



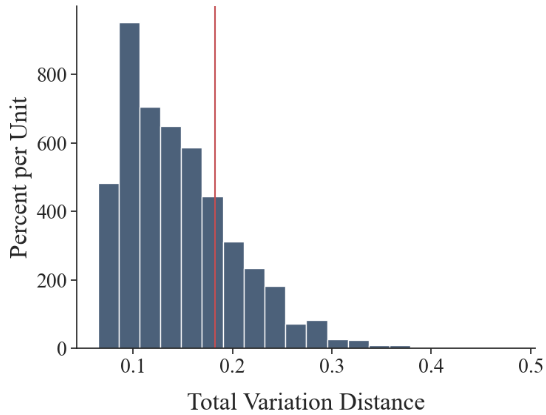
(a) GARP VIOLATIONS



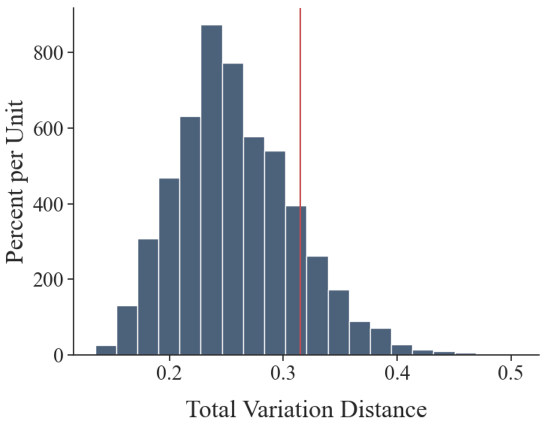
(b) FOSD VIOLATIONS



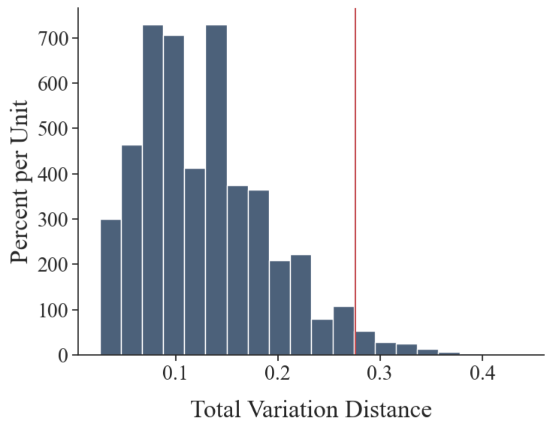
(c) GARP VIOLATIONS, LOW-IQ SUBJECTS



(d) FOSD VIOLATIONS, LOW-IQ SUBJECTS



(e) GARP VIOLATIONS, HIGH-IQ SUBJECTS



(f) FOSD VIOLATIONS, HIGH-IQ SUBJECTS

FIGURE D.1. PERMUTATION TESTS OF THE EFFECT OF SEQUENTIAL ELIMINATION ON ECONOMIC RATIONALITY

Notes: Empirical p-values are (a) < 0.01; (b) < 0.01; (c) < 0.01; (d) 0.24; (e) 0.13; (f) 0.03.

D.2 Individual Behaviors during the Choice Procedures

This section examines whether individual behaviors may differ in the Direct Procedure and Sequential Elimination. To this end, I focus on the orders in which options represented by their presentation orders in the decision problems are eliminated (examined, respectively) in Sequential Elimination (the Direct Procedure, respectively), referred to as *elimination orders* (*examination orders*, respectively). For example, an elimination order (examination order, respectively) of [3,1,2,10,9,5,6,8,11,4,7] indicates that a subject sequentially eliminates (examines, respectively) the third, first,..., and seventh options in a decision problem under Sequential Elimination (the Direct Procedure, respectively). I assess the relationship between these orders in different treatment and cognitive groups using the conventional Spearman and Kendall rank coefficients.

Table D.3 presents the results. The top three rows show that the (median and mean) examination orders of the group significantly correlate with the presentation orders ($p < 0.01$) in the Direct Procedure; and this remains true for both low- and high-IQ subjects. This suggests that subjects tend to examine options sequentially following presentation orders under the Direct Procedure, regardless of their cognitive ability. The same table, on the other hand, indicates that the relationship between presentation orders and elimination behavior under Sequential Elimination is much less considerable in terms of magnitude and statistical significance.

TABLE D.3. RANK CORRELATION COEFFICIENTS BETWEEN DIFFERENT ORDERS

Coefficient / Orders	Spearman		Kendall	
	(1)	(2)	(3)	(4)
Examination and Presentation Orders	1.0	0.995	1.0	0.982
	(<0.01)	(<0.01)	(<0.01)	(<0.01)
-Low-IQ subjects	1.0	0.995	1.0	0.982
	(<0.01)	(<0.01)	(<0.01)	(<0.01)
-High-IQ subjects	1.0	0.995	1.0	0.982
	(<0.01)	(<0.01)	(<0.01)	(<0.01)
Elimination and Presentation Orders	0.472	0.5	0.402	0.426
	(0.14)	(0.12)	(0.13)	(0.11)
-Low-IQ subjects	0.528	0.5	0.446	0.426
	(0.09)	(0.12)	(0.08)	(0.11)
-High-IQ subjects	-0.046	0.5	-0.078	0.426
	(0.89)	(0.12)	(0.76)	(0.11)

Note: This table presents the correlations between examination (as well as elimination) and presentation orders for different subject groups according to the Spearman and Kendall rank coefficients. Columns 1 and 3 measure the coefficients based on the median orders at the group level, while Columns 2 and 4 are based on the mean orders (rounded to integer). *P*-values are reported in parentheses.

Does there exist a presentation order effect on individual choices that can account for the difference in economic rationality between the Direct Procedure and Sequential Elimination? This question is examined by Table D.4, which shows no significant difference in the presentation positions of the choices between the two choice procedures.

TABLE D.4. MANN-WHITNEY U TEST ON THE DIFFERENCE IN THE CHOICES' PRESENTATION POSITIONS BETWEEN THE TREATMENTS

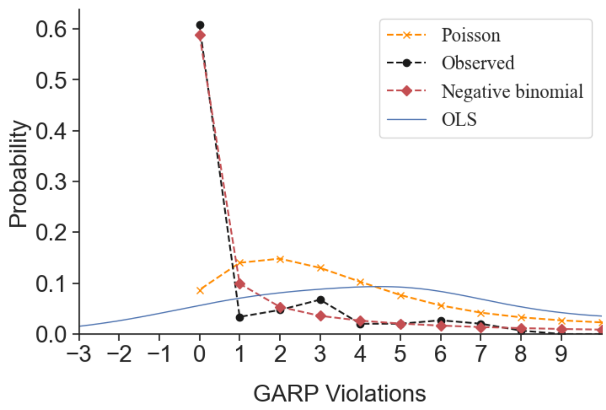
Treatments	Mann-Whitney U Test Statistic
Direct Procedure and Sequential Elimination	2604.5
	(0.61)
-Low-IQ subjects	714.5
	(0.71)
-High-IQ subjects	584.5
	(0.32)

Note: This table presents the results from the Mann-Whitney U Tests of whether there is a difference in the choices' presentation positions between the Direct Procedure and Sequential Elimination for different subject groups. *P*-values are reported in parentheses.

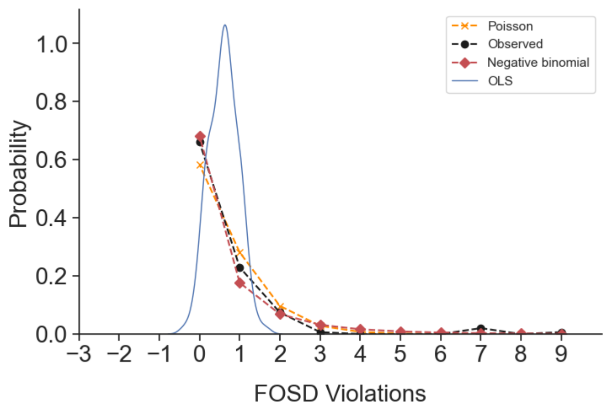
E Details of the Experimental Results

E.1 Model Selection

Figure E.1 presents the probability mass functions of GARP and FOSD violations observed in the experiment, together with their probability mass functions predicted by the Poisson and negative binomial models, as well as the probability density functions of the OLS predicted values based on kernel density estimation. In all the models, the regressors include sequential elimination, high-IQ, the interaction between the previous two, selective attention, working memory, age, female, education, time, and attitude toward inconsistency. The figure shows that the negative binomial models provide a good fit for the observed data. Furthermore, Table E.1 presents the model comparisons based on several conventional criteria. First, the negative differences in the Akaike information criterion (AIC), Bayesian information criterion (BIC) suggest that the negative binomial models can be considered markedly better. Also, the Likelihood Ratio (LR) tests indicate that the negative binomial models perform significantly better than the OLS or Poisson models ($p < 0.01$). Finally, the table shows the Vuong test (Vuong, 1989) for comparing the negative binomial versus Poisson models, the results of which also favor the former. Based on this analysis, this paper uses the negative binomial models for the empirical specifications.



(a)



(b)

FIGURE E.1. OBSERVED DATA AND MODEL-PREDICTED PROBABILITIES

Notes: The figures display the probability density functions of the OLS-predicted values based on kernel density estimation instead of the values' probabilities.

TABLE E.1. COMPARISONS OF MODELS FOR ESTIMATING THE EFFECTS OF SEQUENTIAL ELIMINATION

Models being compared with the negative binomial model	AIC difference	BIC difference	LR Test p-values	Vuong Test p-values
GARP violations				
OLS	-561.4985	-561.499	< 0.01	
Poisson	-1474.19	-1469.19	< 0.01	< 0.01
FOSD violations				
OLS	-205.3137	-205.3137	< 0.01	
Poisson	-42.42791	-37.4307	< 0.01	< 0.01

Notes: Lower AIC or BIC scores indicate a better fit of the model with the data; hence, a negative difference between the scores of any two models suggests that the first model is the better-fit model. LR Tests are conducted based on the null hypotheses that the OLS or Poisson models are better models than the negative binomial models; similarly, Vuong Tests are performed for Poisson and negative binomial models. The rejection of the null hypotheses suggests that the negative binomial models significantly improve model fitness over the other models.

E.2 Economic Rationality

TABLE E.2. DETERMINANTS OF ECONOMIC RATIONALITY (ORIGINAL FORM)

	GARP violations (1)	FOSD violations (2)	SARP violations (3)	HM index (4)	CCEI (5)
Sequential Elimination	-1.086**	-0.413	-0.963**	-0.408	-0.020
	(0.508)	(0.395)	(0.486)	(0.336)	(0.019)
Sequential Elimination× high-IQ	1.386**	-1.086*	1.225*	0.764	0.034*
	(0.658)	(0.611)	(0.641)	(0.482)	(0.020)
High-IQ	-1.830***	0.570	-1.629***	-0.762**	-0.038**
	(0.460)	(0.432)	(0.439)	(0.323)	(0.015)
Selective Attention	-0.045	-0.048	-0.040	-0.017	-0.003
	(0.053)	(0.045)	(0.049)	(0.034)	(0.002)
Working Memory	-0.056	-0.071	-0.057	-0.117	-0.001
	(0.076)	(0.075)	(0.073)	(0.076)	(0.003)
Age	-0.072*	-0.100***	-0.064*	-0.057**	-0.001**
	(0.038)	(0.031)	(0.034)	(0.025)	(0.001)
Female	0.140	0.265	-0.023	-0.173	0.003
	(0.330)	(0.280)	(0.313)	(0.235)	(0.009)
Education	-0.195	0.332**	-0.141	0.060	-0.000
	(0.191)	(0.165)	(0.184)	(0.119)	(0.004)
Response time (minutes)	-0.078***	0.019	-0.066**	-0.035*	-0.002*
	(0.027)	(0.030)	(0.027)	(0.020)	(0.001)
Attitude toward inconsistency	-0.133**	0.033	-0.123**	-0.043	-0.002
	(0.060)	(0.051)	(0.057)	(0.039)	(0.002)
Constant	6.888***	1.828*	6.507***	-0.384	0.166***
	(1.143)	(1.017)	(1.084)	(0.738)	(0.047)
N	148	148	148	148	148

Notes: Robust standard errors are reported in parentheses. Reported p-values for the tests of Sequential Elimination's effects on GARP violations overall and for the 1st IQ quartile subjects are based on one-tailed hypothesis tests. All other significance levels are based upon two-tailed hypothesis tests. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

E.3 Analysis of the Liberal Procedure

TABLE E.3. EFFECTS OF THE LIBERAL PROCEDURE ON ECONOMIC RATIONALITY

	GARP violations (1)	FOSD violations (2)
Liberal Procedure	-3.009	-0.301*
	(3.232)	(0.182)
-Low-IQ subjects	-8.449	0.101
	(5.488)	(0.222)
-High-IQ subjects	3.275	-0.877***
	(2.454)	(0.292)
High-IQ	-7.003**	0.067
	(3.382)	(0.195)
Selective attention	-0.306	-0.018
	(0.586)	(0.028)
Working memory	-0.786	-0.111**
	(0.640)	(0.049)
Age	-0.111	0.010
	(0.312)	(0.019)
Female	2.902	0.336*
	(2.982)	(0.178)
Education	-3.174*	0.034
	(1.641)	(0.088)
Response Time (Minutes)	-0.559	-0.064
	(0.470)	(0.043)
Attitude toward inconsistency	-0.893	0.021
	(0.555)	(0.032)
N	150	150

Notes: Robust standard errors are reported in parentheses. Reported p-values for the tests of Sequential Elimination's effects on GARP violations overall and for the 1st IQ quartile subjects are based on one-tailed hypothesis tests. All other significance levels are based upon two-tailed hypothesis tests. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

TABLE E.4. EFFECTS OF THE LIBERAL PROCEDURE ON ECONOMIC RATIONALITY (ORIGINAL FORM)

	GARP violations (1)	FOSD violations (2)
Liberal Procedure	-0.831*	0.173
	(0.471)	(0.391)
High-IQ	-1.828***	0.665*
	(0.450)	(0.399)
Liberal Procedure× high-IQ	1.690**	-2.044***
	(0.710)	(0.615)
Selective attention	-0.041	-0.028
	(0.072)	(0.044)
Working memory	-0.105	-0.176***
	(0.088)	(0.068)
Age	-0.015	0.016
	(0.040)	(0.028)
Female	0.390	0.553*
	(0.363)	(0.283)
Education	-0.425**	0.054
	(0.174)	(0.138)
Response time (minutes)	-0.075	-0.102
	(0.057)	(0.066)
Attitude toward inconsistency	-0.120**	0.033
	(0.056)	(0.051)
N	150	150

Notes: Robust standard errors are reported in parentheses. Reported p-values for the tests of Sequential Elimination's effects on GARP violations overall and for the 1st IQ quartile subjects are based on one-tailed hypothesis tests. All other significance levels are based upon two-tailed hypothesis tests. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

TABLE E.5. DETERMINANTS OF INDIVIDUAL PREFERENCES FOR SEQUENTIAL ELIMINATION (PROBIT, ORIGINAL FORM)

	Probability of choosing Sequential Elimination	
	(1)	(2)
IQ	-0.151**	
	(0.074)	
High-IQ		-0.667*
		(0.362)
Selective attention	-0.089	-0.081
	(0.059)	(0.058)
Working memory	-0.137*	-0.146*
	(0.075)	(0.077)
Age	-0.015	-0.022
	(0.026)	(0.026)
Female	0.391	0.394
	(0.339)	(0.340)
Education	0.409**	0.397**
	(0.164)	(0.162)
Attitude toward inconsistency	0.011	0.021
	(0.070)	(0.070)
Constant	3.135**	2.751**
	(1.341)	(1.317)
N	75	75

Notes: Robust standard errors are reported in parentheses. Reported p-values for the tests of Sequential Elimination's effects on GARP violations overall and for the 1st IQ quartile subjects are based on one-tailed hypothesis tests. All other significance levels are based upon two-tailed hypothesis tests. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

E.4 Choice Revision

TABLE E.6. EFFECTS OF CHOICE REVISION ON ECONOMIC RATIONALITY (AVERAGE MARGINAL EFFECTS)

	GARP violations (1)	FOSD violations (2)
Choice revision	-2.936	-0.322
	(2.172)	(0.212)
- Under the Direct Procedure	-4.012	-0.185
	(3.189)	(0.373)
- Under Sequential Elimination	-1.690	-0.445**
	(2.815)	(0.203)
Sequential Elimination	-1.383	-0.481**
	(2.017)	(0.196)
High-IQ	-5.422***	-0.145
	(2.039)	(0.170)
Selective Attention	-0.157	-0.004
	(0.234)	(0.028)
Working Memory	-0.533	-0.091
	(0.452)	(0.061)
Age	-0.469**	-0.055***
	(0.236)	(0.019)
Female	0.278	0.117
	(2.064)	(0.162)
Education	0.183	0.143
	(1.005)	(0.100)
Response time (minutes, Block A)	-0.408**	0.007
	(0.191)	(0.016)
Response time (minutes, Block B)	0.071	-0.025
	(0.315)	(0.046)
Attitude toward inconsistency	-0.758*	-0.004
	(0.415)	(0.027)
N	148	148

Notes: Robust standard errors are reported in parentheses. Reported p-values for the tests of Sequential Elimination's effects on GARP violations overall and for the 1st IQ quartile subjects are based on one-tailed hypothesis tests. All other significance levels are based upon two-tailed hypothesis tests. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

TABLE E.7. EFFECTS OF CHOICE REVISION ON ECONOMIC RATIONALITY (ORIGINAL FORM)

	GARP violations (1)	FOSD violations (2)
Choice revision	-0.626	-0.215
	(0.446)	(0.424)
Sequential Elimination	-0.411	-0.413
	(0.555)	(0.417)
Choice revision $\times$ Sequential Elimination	0.276	-1.009
	(0.704)	(0.637)
High-IQ	-1.146***	-0.250
	(0.356)	(0.295)
Selective Attention	-0.029	-0.006
	(0.043)	(0.047)
Working Memory	-0.099	-0.155*
	(0.076)	(0.091)
Age	-0.087**	-0.094***
	(0.038)	(0.028)
Female	0.051	0.199
	(0.385)	(0.281)
Education	0.034	0.244
	(0.187)	(0.151)
Response time (minutes, Block A)	-0.076**	0.013
	(0.031)	(0.027)
Response time (minutes, Block B)	0.013	-0.042
	(0.059)	(0.077)
Attitude toward inconsistency	-0.141**	-0.007
	(0.062)	(0.045)
Constant	6.747***	2.616***
	(1.129)	(0.936)
N	148	148

Notes: Robust standard errors are reported in parentheses. Reported p-values for the tests of Sequential Elimination's effects on GARP violations overall and for the 1st IQ quartile subjects are based on one-tailed hypothesis tests. All other significance levels are based upon two-tailed hypothesis tests. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

E.5 Eliciting Risk Preferences under Choice Procedures

TABLE E.8. EFFECTS OF SEQUENTIAL ELIMINATION ON ELICITED RISK PREFERENCES (AVERAGE MARGINAL EFFECTS)

	CRRA utility index	
	(1)	(2)
IQ	-0.397*	-0.358
	(0.230)	(0.227)
-Under the Direct Procedure		0.071
		(0.320)
-Under Sequential Elimination		-0.799**
		(0.397)
Sequential Elimination	2.010	2.063
	(1.619)	(1.628)
Age	-0.079	-0.078
	(0.127)	(0.128)
Female	1.964	1.974
	(1.383)	(1.380)
Education	0.702	0.633
	(0.695)	(0.705)
Selective attention	-0.239	-0.216
	(0.252)	(0.240)
Working memory	-0.400	-0.449
	(0.347)	(0.364)
Response time (minutes)	-0.151	-0.164
	(0.196)	(0.192)
Attitude toward inconsistency	0.164	0.143
	(0.283)	(0.286)
N	148	148

Notes: This table reports the average marginal effects resulting from OLS regression analyses of CRRA utility indices. Robust standard errors are reported in parentheses. In Column 1, the OLS coefficients exactly reproduce the marginal effects. The regression in Column 2 is reported in the original form in Table E.9. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

TABLE E.9. EFFECTS OF SEQUENTIAL ELIMINATION ON ELICITED RISK PREFERENCES (ORIGINAL FORM OF COLUMN 2 IN TABLE E.8)

	CRRA utility index (1)
IQ	0.071
	(0.320)
Sequential Elimination	6.182*
	(3.568)
Sequential Elimination×IQ	-0.870
	(0.558)
Selective Attention	-0.216
	(0.240)
Working Memory	-0.449
	(0.364)
Age	-0.078
	(0.128)
Female	1.974
	(1.380)
Education	0.633
	(0.705)
Response time (minutes)	-0.164
	(0.192)
Attitude toward inconsistency	0.143
	(0.286)
Constant	9.721*
	(5.791)
N	148

Notes: Robust standard errors are reported in parentheses. Reported p-values for the tests of Sequential Elimination's effects on GARP violations overall and for the 1st IQ quartile subjects are based on one-tailed hypothesis tests. All other significance levels are based upon two-tailed hypothesis tests. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.