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Manipulating Reliance on Intuition Reduces Risk and Ambiguity Aversion

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Abstract

Prior research suggests that those who rely on intuition rather than effortful reasoning when making decisions are less averse to risk and ambiguity. The evidence is largely correlational, however, leaving open the question of the direction of causality. In this paper, we present experimental evidence of causation running from reliance on intuition to risk and ambiguity preferences. We directly manipulate participants' predilection to rely on intuition and find that enhancing reliance on intuition lowers the probability of being ambiguity averse by 30 percentage points and increases risk tolerance by about 30 percent in the experimental sub-population where we would *a priori* expect the manipulation to be successful (males).

JEL classification: **D81; D83.**
Keywords: Risk Aversion, Ambiguity Aversion, Decision Theory, Dual Systems, Intuitive Thinking.

1. Introduction

Understanding what shapes individuals' attitudes toward risk and uncertainty is of fundamental importance to economists. Building on research in psychology arguing that intuition may provide better decisions in a variety of situations than the deliberative, effortful, reasoning typically associated with rationality (Gigrenzer and Todd, 1999; Dijksterhuis 2004), in Butler, Guiso and Jappelli (2012) we document a robust relationship between reliance on intuition and tolerance for risk and ambiguity in both experimental and large-scale representative survey data: those who more readily rely on their intuition when making decisions are also significantly more tolerant of risk and ambiguity.

Still, the direction of causation in these findings can be debated: are more uncertainty-tolerant individuals more likely to rely on their intuition, or does reliance on intuition reduce aversion to risk and ambiguity? In this paper we provide the first experimental evidence directly addressing the question of whether variation in reliance on intuition *causes* shifts in such economically fundamental preferences as aversion to risk and ambiguity. To this end we adapt the design of Pham, Lee and Stephen (2012) to our specific question and directly manipulate experimental participants' willingness to rely on intuition—either reinforcing participants' pre-existing predilections (High Intuition Treatment) or undermining them (Low Intuition Treatment)—before collecting incentive-compatible measures of their risk and ambiguity preferences.

We find that male participants randomly assigned to the High Intuition Treatment are 30 percentage points less likely to be ambiguity averse, and 30 percent more risk tolerant according to a standard measure, than male participants randomly assigned to the Low Intuition Treatment. We find no effect for female participants, a non-result which could be anticipated if females already exhibit a high propensity to rely on intuition which weakens the effect of our manipulation. We provide evidence in support of this interpretation of the gender patterns we find.

The remainder of the paper proceeds as follows. In the following section we outline closely related literature. In Section 3, we present the experimental design followed by results in Section 4. Section 5 concludes.

2. Related Research

Research in psychology suggests that people rely on two modes of thinking when making decisions.[1] In the terminology of Stanovich and West (2000), the first mode of decision making (System 1) is intuitive thinking, while the second mode (System 2) is based on effortful reasoning and systematic processing of information. System 2 is calculative, analytical and controlled and involves systematic conscious comparisons of different alternatives. While such deliberative reasoning is slow, System 1 is quick, automatic and can even be unconscious.[2] Although the prevailing view in economics is that reliance on System 1—e.g., heuristic decision making—leads to worse decision-making (see, e.g., Kahneman 2011), a handful of papers in the psychological dual-systems vein provide evidence of the superior quality of decisions associated with System 1 across various contexts (*inter alia*, Gigerenzer and Todd, 1999; Dijksterhuis, 2004), particularly when decisions are complex.

Moreover, Klein (1998; 2003) conjectures a direct link between decision mode and attitudes towards uncertainty by observing that intuitive thinking is uniquely suited to adventurous behavior and risk taking. The key point is that intuition can handle severe uncertainty so that individuals who are better at using System 1 may also feel more comfortable dealing with uncertainty and risk (though no distinction is made between the two) and thus develop higher tolerance for both. It is this feeling of comfort with *detection* and *learning* about risks that could make intuitive thinkers more tolerant to risk and uncertainty.

Also related are studies investigating the effect on decision quality of relying on emotion versus more deliberative processes. Pham, Lee and Stephen (2012) implement experimental

[1] See Sloman (1996), Evans and Over (1996), Hammond (1996), Stanovich and West (2000), Gilovich et al. (2002), Kahneman (2003) and Slovic (2003).

[2] Recent research comparing how fraternal and paternal twins make decisions suggests that reliance on these decision modes has a genetic component and is a stable, individual, trait, see Bouchard and Hur (1998). Our experiment shows that decision mode is stable across contexts, and that participants who take longer to reach decisions involving uncertain monetary outcomes also took longer to make choices in decisions free of monetary consequences (see Table A2 in the Appendix).

treatments which either reinforce or undermine participant's reliance on emotion in decision-making and then have participants predict various outcomes, finding enhanced reliance on emotion when forecasting outcomes significantly increases predictive accuracy across a wide array of situations and time horizons. Interpreting emotion as the opposite of deliberation, Lee, Amir and Ariely (2009) manipulate experimental participants' reliance on emotion by, in one treatment, placing some subjects under cognitive load and some not, finding reliance on emotion enhances transitivity—a precursor to rationality. More tangentially related to the current inquiry is Inbar, Cone and Gilovich (2010), where the authors investigate what features of a decision problem cue deliberative processes versus intuitive processes. They find evidence that more precisely-stated questions tend to cue rationality.[3]

3. Experimental Design and Procedures

The experiment was conducted using the on-line labor market Mechanical Turk. Participation was restricted to Mechanical Turk workers residing in the United States. In total about 300 individuals participated in the experiment. The experimental design involves two phases and two treatments. Only the first phase—the reliance on intuition manipulation phase—varies across treatments. The second phase, in which we elicit ambiguity and risk preferences, is identical across treatments.

Our two treatments are referred to as "High Intuition" and "Low Intuition." In the first phase of the High Intuition (Low Intuition) treatment, participants are asked to briefly describe two (ten) situations in which they relied on their intuition to make a decision and it turned out to be the correct thing to do.[4] The reasoning behind these treatments is that listing two

[3] It is worth noting that, while the authors of this last study claim to find evidence that more rationality is associated with less ambiguity aversion, and more intuitive processes with more ambiguity aversion—i.e., the opposite of what we find—their results are actually not clear on this point. This is primarily because what they describe as an ambiguous urn in one of their treatments is actually non-ambiguous. The urn in question contained "`…at least two red marbles out of the 100, adding that `any number of red marbles from exactly two all the way up to 100 is equally likely.'" This urn, while certainly relatively complex and representing a two-stage lottery, is non-ambiguous because the number of red marbles in it is known to participants to be uniformly distributed from 2 to 100.

[4] The situations participants listed varied widely. Some examples of actual responses: "I made the right decision not to buy a particular car, the guy selling it was a con artist;" "Asking a girl out I saw on the street that I dated

situations where intuition provided correct advice should be relatively easy for most people, so that the High Intuition treatment should enhance participants' willingness to rely on their intuition in subsequent decisions. On the other hand, coming up with ten such situations will be difficult for many people, bringing to mind some cases where intuition failed, so that this treatment should not enhance, or may even undermine, our participants' willingness to rely on their intuition.

The second (common across treatments) phase involves three questions. Participants know that only one of these three questions will be chosen to determine their experimental earnings and that ten percent of participants will be randomly chosen to be paid their experimental earnings. With the first two questions we construct a three-category ambiguity preference measure—ambiguity averse, ambiguity neutral or ambiguity seeking—and with the third question we elicit a continuous risk preference measure. All three questions as well as our method for selecting which participants get paid involve publicly verifiable sources of risk and ambiguity to allay concerns about trusting the experimenter (see, e.g., Schneeweiss, 1973; Kadane 1992).

We elicit ambiguity preferences in a way analogous to the standard two-urn, two-choice Ellsberg question. In the first question, participants are endowed with an asset that pays $10 if a number in the set {0,2,4,5,8} is drawn, and $0 otherwise. Participants must choose between one of two sources from which to draw a number between 0 and 9: (i) the third number drawn in the next California Mid-Day Daily-3 lottery, which is guaranteed by the State to be uniformly distributed over {0,1,…,9}; or (ii) the tenth's digit of the temperature in Sacramento, California just after the next California Mid-Day Daily-3 lottery is conducted.[5] Temperature is considered by many a quintessentially ambiguous object. The second question participants face is identical except the asset now pays off if the experimenters draw a number in the set {1,3,6,7,9}.[6] We classify individuals who choose the non-ambiguous source (state lottery) in

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for 6 months after;" "Getting the $1 insurance plan on head phones and then they broke in 3 weeks;" "Had only glanced in a box lot at a recent auction, but had a feeling that there was something of value in it. Got into a little bidding war with another auction attendee and won. I paid immediately so that I could see the contents of my box and sure enough, buried at the bottom of the box were three gold coins."

[5] That is to say, the "*x*" if the temperature is 72.*x*.To make this temperature as publicly verifiable as possible, we tell participants we will use the publicly available and recorded temperature report on a specific website—www.weatherforyou.com —where the temperature is recorded in 5-minute intervals at the tenth's digit precision.

[6] The sets were chosen to transparently partition the set {0,1,…,9} into two equally likely sets, without using such suggestive options as "all odd" or "all even."

both questions 1 and 2 as ambiguity averse and those who choose the ambiguous source (Sacramento temperature) in both of these questions as ambiguity-seeking.

To obtain a continuous measure of risk preferences, we ask a third, two-stage, question. First, we fix the source of chosen numbers to be the (non-ambiguous) state lottery mentioned above and allow participants to select, for free, one of the two assets mentioned above.[7] We then surprise the participants with a chance to "sell" the asset and elicit their valuation for it using a standard BDM mechanism.[8] We use participants' valuation for the asset elicited in this way as a continuous, incentive compatible, measure of risk preferences which is increasing in risk *tolerance*.

4. Results

In Table 1 we report descriptive statistics of our sample. Our sample is considerably older and less educated than a standard student sample. Also, with the lone exception of gender, there are no significant differences in demographics across treatments. On average, our participants are slightly risk averse—valuing a bet with an expected value of $5 at a bit less than $5. Our participants are also roughly equally divided among being ambiguity averse, neutral or seeking. Finally, notice that in the raw unconditional data, there is little evidence for variation in risk and ambiguity preferences across treatments, prompting us to investigate a bit deeper into the data.

Toward this end, before turning to this deeper analysis it should be noted that our intuition manipulation has the drawback of being relatively one-sided: it is mainly meant to enhance reliance on intuition. Consequently, *a priori* we expect it to have a weak effect on participants who already rely on their intuition. For these individuals it may well be as easy to come up with ten examples as two examples of intuition being a reliable guide. Data collected

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[7] That is to say, participants choose between an asset that pays $10 if the number drawn is in the set {0,2,4,5,8}, and another asset that pays $10 if this number is in the set {1,3,6,7,9}.

[8] Only after they have chosen an asset do they learn of their chance to sell their asset. In the Becker-DeGroot-Marschak (1964) mechanism we use, revealing one's true value for an object is a dominant strategy. To address some of the criticisms raised about the use of this device (e.g., Plott and Zeiler, 2005 or Harrison and R\:{u}tstrom, 2008), we provide an explanation and description of the incentives in mechanism to the participants in layman's terms and draw a "buying price" from a large interval ($0.00 t0 $10.00) using an impartial third-party website (random.org).

for a separate paper (Butler, Guiso and Jappelli, 2012) suggest that women are one such group: responses to a standard psychological battery measuring reliance on intuition—the REI, due to Pacini and Epstein (1999)—reveal that women are ex-ante much more comfortable relying on intuition than men.[9] We document this in Table 2 by regressing the answers to several components of the REI on a gender dummy. Most questions listed are negatively related to reliance on intuition, so that a positive coefficient indicates less reliance on intuition; the exceptions are Q21, Q23 and Q39, where a negative coefficient indicates less reliance on intuition. Depending on the question, the intuition indicator is between 4% and 11% larger for women than for men—a substantial difference as reflected in the significance patterns given the tight distributions typically associated with such scales.[10] Because we expect the effect of our treatments to be much weaker for females, in our main analysis we analyze the results for males and females separately.

In Table 3 we present our main results, splitting the sample by gender. Considering male participants first (top panel), we find a statistically significant difference in both risk and ambiguity preferences across treatments. Columns 1 and 2 report ordered probit estimates using as the dependent variable the three-category measure of ambiguity preferences mentioned above, ordered so as to be increasing in ambiguity tolerance. The positive and significant coefficients on the High Intuition Treatment dummy indicate that this treatment significantly increased male participant's ambiguity tolerance. To get a sense of the magnitude and distribution of this increase, columns 3-6 report marginal effects from a probit model using only a dummy for ambiguity aversion (columns 3-4) or a dummy for being ambiguity seeking (columns 5-6) as the dependent variable. The estimates suggest that the marginal effect of being in the High Intuition Treatment is to decrease the probability of being ambiguity averse and to increase the probability of being ambiguity seeking by around 30 percentage points, suggesting quite a substantial impact of decision mode on preferences for ambiguity.

[9] It only matters that people *think* they can rely on their intuition—not that they actually do—in order to weaken the power of our treatment here. Therefore, use of the REI is appropriate here even though we do not investigate these responses in the paper mentioned.

[10] Table 1 pools all participants from both Experiment 1 and Experiment 2 in Butler, Guiso and Jappelli (2012), where details are given on the subject pools for these two experiments. We use simple OLS for ease of interpretation. Signs and significance levels are similar if, as is more correct given the categorical nature of the dependent variable, ordered probit is used instead.

Next, consider risk preferences. Restricting attention again to male participants (columns 7-8), on average being randomly assigned to the High Intuition treatment increased reported certainty equivalents for a 50/50 win $10, lose $0 bet—our measure of risk tolerance—by about $2 irrespective of demographic controls. In percentage terms, this represents an approximately 30 percent increase in our measure of risk tolerance, controlling for available demographics (column 8).

By way of contrast, among female participants (Table 3, bottom panel), we find no discernible difference in preferences for either risk or ambiguity between our two treatments. Estimated coefficients are all small in magnitude compared to our male participants and consistently non-significant. This is true whether or not one controls for available demographics.

Summing up, among the subset of experimental participants where one would *a priori* expect our manipulation to have an effect (males), we find evidence that directly enhancing reliance on intuition moves risk and ambiguity preferences substantially, increasing tolerance for both risk and ambiguity. Among the subset of participant where we were *a priori* less confident in the strength of our treatments (females), we find little effect.

5. Concluding remarks

Preferences over risk and uncertainty are fundamental to much of economics. Understanding what shapes and moves these attitudes or preferences can help inform our models and analyses. In this paper we provide a link between decision theory and psychological research on decision processes in showing that variation in decision mode—how much one relies on intuition when making choices—can result in substantial variation in preferences for risk and ambiguity.

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Table 1: Descriptive Statistics

The table presents descriptive statistics of experiment participants overall and by treatment. Demographics are self-reported. “Male” is a dummy indicating the participant reported being male indicator variable for male. “Age” is 2012 minus self-reported year born. “Has college degree” is a dummy indicating that the participant ticked “Bachelor's degree” on a list of possible levels of education on which as many as applied could be ticked. “Risk tolerance measure” is the participant’s certainty equivalent for a 50/50 win $10/lose $0 lottery as described in the text. There is little difference in demographics across treatments, indicating that randomization into treatments was generally successful, the major exception being gender.

Descriptive Statistics

		Treatment			t-test
	Overall	Low Intuition	High Intuition	Obs not missing	High Intuition = Low Intuition
Male	0.36	0.31	0.43	298	p = 0.04
	(0.03)	(0.04)	(0.04)		
Age	36.16	37.06	35.43	296	p = 0.25
	(0.71)	(1.09)	(0.93)		
College degree	0.39	0.36	0.41	298	p = 0.32
	(0.03)	(0.04)	(0.04)		
Income ≤ $30K	0.46	0.43	0.49	293	p = 0.32
	(0.03)	(0.04)	(0.04)		
$30K < Inc ≤ $70K	0.39	0.39	0.38	293	p = 0.79
	(0.03)	(0.04)	(0.04)		
Income > $70K	0.15	0.17	0.13	293	p = 0.30
	(0.02)	(0.03)	(0.03)		
Ambiguity averse	0.35	0.29	0.39	298	p = 0.06
	(0.03)	(0.04)	(0.04)		
Ambiguity seeking	0.33	0.37	0.29	298	p = 0.14
	(0.03)	(0.04)	(0.04)		
Risk tolerance measure	4.69	4.48	4.87	298	p = 0.18
	(0.14)	(0.21)	(0.19)		
Obs	298	134	164		

Table 2. Impact of Gender on Responses to the Rational Experiential Inventory

Each row of the table reports the coefficient from a separate OLS model using as the dependent variable responses to selected Rational Experiential Inventory (REI) questions and as the sole explanatory variable an indicator for being male. For each REI question, participants are asked: "Please indicate using a scale from 1 to 5 how true each of the following statements is as it pertains to you, where 1 = `the statement is completely false' and 5 = `the statement is completely true.'". Both signs and significance levels are robust to controlling for our standard set of demographic controls, including age, math score—a measure of cognitive ability—and total family income for all questions and to estimating ordered probit models instead of OLS. Most questions listed are negatively related to reliance on intuition, so that a positive coefficient indicates less reliance on intuition; the exceptions are Q21, Q23 and Q39, where a negative coefficient indicates less reliance on intuition. Standard errors in parentheses, ******* = significant at 1% level, ****** = significant at 5% level, ***** = significant at 10% level.

	Coefficient (Std Error)			
REI Question Number	Male Dummy		Constant	
Q1 = "I have a logical mind"	0.25***	(0.05)	3.69***	(0.04)
Q14 = "I am much better at figuring things out logically than most people"	0.17***	(0.05)	3.82***	(0.04)
Q21 = "I hardly ever go wrong when I listen to my deepest gut feelings to find an answer"	-0.15***	(0.05)	3.05***	(0.04)
Q22 = "I think it is foolish to make important decisions based on feelings"	0.14**	(0.05)	3.20***	(0.04)
Q23 = "I tend to use my heart as a guide for my actions."	-0.33***	(0.05)	2.93***	(0.04)
Q26 = "I enjoy intellectual challenges."	0.15**	(0.05)	3.95***	(0.04)
Q30 = "Using logic usually works well for me in figuring out problems in my life."	0.22***	(0.05)	3.58***	(0.04)
Q39 = "I am not very good at solving problems that require careful logical analysis."	-0.15***	(0.05)	2.11***	(0.04)
Q40 = "I enjoy solving problems that require hard thinking."	0.28***	(0.05)	3.51***	(0.04)
Observations	1304			

Table 3. Risk and Ambiguity Tolerance, by Gender

The table shows the effect of High intuition treatment on preferences for risk and ambiguity. Columns 1 and 2 present ordered probit estimates. Columns 3-6 report marginal effects estimated from a probit model. Columns 7 and 8 report OLS estimates. "High intuition treatment" is an indicator variable that takes the value of one if the manipulation was designed to enhance confidence in intuition. "Ambiguity tolerance" is a 3-category variable *increasing* in ambiguity tolerance: it takes the value 0 if the participant is ambiguity averse, 1 if neither ambiguity averse nor ambiguity seeking and 2 if ambiguity seeking. Ambiguity averse (seeking) are indicator variables taking the value of 1 if the participant was classified as ambiguity averse (seeking) and 0 otherwise. "Risk tolerance" is a continuous variable *increasing* in risk tolerance. Demographic controls are: age, age squared, college degree (binary) and dummies for low and medium income. All estimates include controls for: i) (local) time of day, which has been shown to attitudes toward uncertainty toward; ii) time zone as a proxy for regional differences in attitudes; iii) time spent on phase 1 of the experiment, to control for unequal earnings expectations due to the difference in time required to list two versus ten relevant situations; and iv) the source (lottery or temperature) determining the 10% of participants chosen to be paid; and v) session fixed effects. Standard errors in parentheses, ******* = significant at 1% level, ****** = significant at 5% level, ***** = significant at 10% level.

	Ambiguity tolerance (3-cat)		Ambiguity averse		Ambiguity seeking		Risk tolerance (continuous)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Male participants only				
High Intuition treatment	0.76**	0.85**	-0.32**	-0.34*	0.26*	0.29**	2.12***	1.96**
	(0.32)	(0.39)	(0.15)	(0.18)	(0.13)	(0.15)	(0.74)	(0.78)
Constant							3.68**	7.12**
							(1.58)	(2.96)
Demographic controls?	N	Y	N	Y	N	Y	N	Y
Obs	106	105	106	105	106	105	106	105
R-squared	0.09	0.11	0.19	0.25	0.13	0.15	0.23	0.30
				Female participants only				
High Intuition treatment	-0.05	-0.03	0.04	0.01	0.04	0.02	-0.25	-0.36
	(0.29)	(0.30)	(0.11)	(0.12)	(0.11)	(0.11)	(0.61)	(0.63)
Constant							6.08***	8.45***
							(0.95)	(2.46)
Demographic controls?	N	Y	N	Y	N	Y	N	Y
Obs	187	181	187	181	187	181	187	181
R-squared	0.08	0.08	0.13	0.14	0.11	0.11	0.11	0.12

Instructions Appendix

[Screen 1]

Welcome to Experiment 132

Thank you for agreeing to participate in our experiment. This is a study in decision making. Throughout the course of the study, which should take no more than a handful of minutes, we will ask you to make various decisions and answer a few questions. When responding, please keep in mind that this is not a test -- i.e., there are no correct or incorrect answers. We are only interested in your actual decisions, preferences and thoughts.

To proceed, please enter your Mechanical Turk worker id. This allows us to know whom to pay. It has the further benefit of allowing us, to some extent, to screen out robots.

[Screen 2]

Instructions, page 1

This experiment involves two parts:

1. In the first part, we ask you to respond to a simple question. Your response in first part will not affect your earnings from this experiment at all.
2. In the second part, you will be asked to make a few decisions involving monetary consequences. Your decisions in this second part will determine your ***potential*** earnings from this experiment.
3. In particular, one of the decision scenarios in the second part will be chosen, at random, to determine your potential earnings from the experiment. Since each of the decision scenarios may therefore completely determine your potential earnings from this experiment, it is in your best interest to choose according to your true preferences.

Approximately **ten percent** (10%) of participants will *actually* be paid their **potential** earnings from this experiment. The remaining participants will be paid only the fixed fee listed on the HIT.

How we choose the ten percent of participants to pay is detailed on the next page.

[Screen 3A. *Please note that only one of screens 3A or 3B is shown; which one shown is randomly determined*]

Instructions, page 2

To be as fair and transparent as possible, the ten percent (10%) of participants who will actually be paid their potential earnings are determined as follows:

- On the next page, you will choose a number from 0 to 9.
- We will compare your chosen number to the first number to the right of the decimal point of the temperature in Sacramento, California just before 1 pm (California time) the next time this occurs after you complete this experiment.
- If these two numbers match, you will actually be paid your ***potential*** earnings from this experiment; otherwise, you will earn only the fixed participation fee listed on the HIT.
- These earnings will be paid as a bonus to your mechanical turk worker account.
- To be clear, if the temperature is 72.5, the relevant number is "5."
- To avoid misunderstandings, we will use the temperature as publicly reported here: **http://www.pwsweather.com/obs/GREENHAVEN.html**, where it is recorded every 5 minutes. We will use the report closest to, but still before, before 1pm.

When you have read and understood these terms, continue to the next page to select a number.

[Screen 3B: note, only one of screens 3A or 3B is shown; which one shown is randomly determined]

To be as fair and transparent as possible, the ten percent (10%) of participants who will actually be paid their potential earnings are determined as follows:

- On the next page, you will choose a number from 0 to 9.
- We will compare your chosen number to the first number drawn in the next California mid-day Daily 3 (around 1 pm, California time) the next time this occurs after you complete this experiment.
- If these two numbers match, you will actually be paid your ***potential*** earnings from this experiment; otherwise, you will earn only the fixed participation fee listed on the HIT.
- These earnings will be paid as a bonus to your mechanical turk worker account.
- To be clear, if the numbers drawn are 5 4 3, the relevant number is "5."
- To avoid misunderstandings, we will use the numbers drawn as publicly reported here: **http://www.calottery.com/play/draw-games/daily-3**

When you have read and understood these terms, continue to the next page to select a number.

[Screen 4]

Select a number:

( ) 0 ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9

[Screen 5]

Instructions, page 3

Please note:

The decision scenarios in the second part of the experiment will depend on two ways of randomly determining whole numbers from 0 to 9.

The first way is to use the results from "California (mid-day) Daily 3," an official California state lottery, the next time this lottery is conducted after you submit your experiment. This lottery is conducted every day around 1pm (California time) and the results are always posted on the official website a few minutes after 1pm. We will use either the first, second, or third number drawn, specifying each time which draw is relevant.

The second way is to rely on the digit just to the right of the decimal point of the temperature in Sacramento, California just after 1 pm (California time). At the weather site listed below, this temperature is publicly reported and recorded every five minutes. The relevant temperature will be the closest temperature report to, but still *after* 1 pm. To be clear, if the temperature in Sacramento is 72.5 degrees fahrenheit in this report, the relevant number would be "5."

To be as transparent as possible, we will use the following publicly reported sources:

- Sacramento temperature: **http://www.pwsweather.com/obs/GREENHAVEN.html**
- California (mid-day) Daily 3: **http://www.calottery.com/play/draw-games/daily-3**

[Screen 6A: Low Intuition treatment. ***Please note that only one of screens 6A or 6B is shown; which one shown is randomly determined*****]**

Part 1

Many scientists and researchers across various academic disciplines believe that people rely on two modes of thinking when making decisions. The first mode of decision making can be thought of as "intuitive thinking," while the second mode of thought is based on effortful reasoning and systematic processing of information. This second mode of thought - "deliberative reasoning" - is calculative, analytical and controlled and involves systematic conscious comparisons of different alternatives. "Intuitive thinking," on the other hand, is quick, automatic and can even be unconscious

Please briefly describe 10 situations in which you trusted your intuition to make a judgment or a decision and it was the right thing to do.

Situation 1: ___________________________

Situation 2: ___________________________

Situation 3: ___________________________

Situation 4: ___________________________

Situation 5: ___________________________

Situation 6: ___________________________

Situation 7: ___________________________

Situation 8: ___________________________

Situation 9: ___________________________

Situation 10: ___________________________

[Screen 6B: High Intuition treatment]

Part 1

Many scientists and researchers across various academic disciplines believe that people rely on two modes of thinking when making decisions. The first mode of decision making can be thought of as "intuitive thinking," while the second mode of thought is based on effortful reasoning and systematic processing of information. This second mode of thought - "deliberative reasoning" - is calculative, analytical and controlled and involves systematic conscious comparisons of different alternatives. "Intuitive thinking," on the other hand, is quick, automatic and can even be unconscious

Please briefly describe 2 situations in which you trusted your intuition to make a judgment or a decision and it was the right thing to do.

Situation 1: ___________________________

Situation 2: ___________________________

[Screen 7]

You will now begin the second part of the experiment. This section consists of three separate decision-making scenarios, each of which involves an opportunity to make money. Each new decision-making scenario will be clearly labeled as it arises.

Please note that *only one* of the three decision-making scenarios will be chosen, at random, to determine your earnings. Since each of the three scenarios may determine your earnings from this experiment, it is in your best interest to choose according to your true preferences in each scenario.

Click "Next" to proceed to the first decision-making scenario

[Screen 8]

Decision-making Scenario 1

You are given one lottery ticket for free. This ticket pays you $10 if a randomly selected number is one of the following: 0, 2, 5, 6, or 8. You get to choose from where to draw the number. You can choose between one of two sources:

- the third number drawn in the next "California Mid-Day Daily 3"
- the temperature in Sacramento, California

Choose the source from which to draw a number: *[order in which options appear is randomized]*

( ) California Mid-Day Daily 3

( ) Temperature in Sacramento, California

[Screen 9]

Decision-making Scenario 2

You are given one lottery ticket for free. This ticket pays you $10 if a randomly selected number is one of the following: 1, 3, 6, 7, or 9. You get to choose from where to draw the number. You can choose between one of two sources:

- the third number drawn in the next "California Mid-Day Daily 3"
- the temperature in Sacramento, California

Choose the source from which to draw a number: *[order in which options appear is randomized]*

( ) California Mid-Day Daily 3

( ) Temperature in Sacramento, California

[Screen 10]

Decision-making Scenario 3:

You are offered the choice between two lottery tickets. Earnings from the two lottery tickets are determined by the third number drawn in the next "California Mid-Day Daily 3" as follows:

- Ticket L pays $10 if this number is 0, 2, 5, 6, or 8
- Ticket R pays $10 if this number is 1, 3, 4, 7, or 9

Choose a ticket: *[order in which options appear is randomized]*

( ) Ticket L

( ) Ticket R

[Screen 11]

Decision-making Scenario 3, continued

You now have the opportunity to sell the ticket you just chose, for a price.

- You will report the lowest price you would accept in order to sell your ticket.
- At the same time, we will randomly choose a price to offer you for the ticket, from $0.00 to $10.00.

- If our "offer price" is larger than the number you report, we will pay you the offer price in exchange for your ticket.
- If our "offer price" is less than or equal to the number you report, you keep your ticket.

More details are provided below.

What is the lowest price you would accept to give up your lottery ticket? **_______**

More details

In order to give you incentives to truthfully report your lowest acceptable price as accurately as possible:

- We will randomly choose a number from 0.00 to 10.00 using the website random.org.
- Call this number "z."
- If z is higher than the "lowest acceptable price" you report, we will pay you $z, but take away your lottery ticket.
- If z is less than or equal to your reported "lowest acceptable price," you keep your lottery ticket but we do not pay you z.

You can think of the number we randomly draw as an amount of money you are offered for your ticket. If the amount of money you are offered is high enough, you sell your ticket. If the amount of money offered is too low, you keep your ticket. What is "high enough" or "too low" is up to you to decide.

[Screen 12]

<u>Tell us about yourself</u>

You are now finished with the experiment. Thanks for your time and effort - we really appreciate it.

On the next page you will be provided with a unique end-of-experiment code that you will use to complete your HIT.

Before you go, however, please take a moment to tell us a few things about yourself. Every question on this page is voluntary and will not affect your earnings from this experiment in any way.

Gender?

In what year were you born?

In what month were you born?

In what country were you born?

[If born in the US:] In what US state were you born?

Approximately what was your total income last fiscal year?

( ) $10,000 or less
( ) $10,001 - $30,000
( ) $30,001 - $50,000
( ) $50,001 - $70,000
( ) $70,001 - $90,000
( ) $90,001 - $110,000
( ) $110,001 - $130,000
( ) $130,001 - $150,000
( ) $150,001 - $170,000
( ) $170,001 - $190,000
( ) $190,001 or more

Which of the following academic degrees have you obtained (check all that apply)

( ) High school diploma
( ) Some college, but no degree
( ) Associate degree
( ) Bachelor's degree
( ) Master's degree
( ) Technical certificate
( ) Professional degree
( ) PhD

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