

Online Appendices for “An Expected Utility Maximizer Walks Into A Bar...”

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Abstract

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APPENDICES FOR ONLINE PUBLICATION

A Experimental Methods & Measurement

In all three of our experiments the instructions and choice experiments were computerized using the experimental software E-Prime 1.2. The compiled instruction/practice and experimental programs are available from the authors on request. The scripts read to subjects during the instruction/practice phase are included in the specific experimental sections below.

Potential participants were approached by an experimenter and told that we were from NYU and that we were conducting an experiment in this bar. Potential participants were given a flyer with some information about the experiment (including payoffs and that they would be breathalyzed). If a potential participant expressed interest in being a subject, they were then given a copy of the consent document to review and then asked the quiz questions. Upon successfully answering four out of five quiz questions correctly they were invited to participate. Our experimental “workstation” was always located in the back of the bar at a relatively isolated and quiet table. The experimenter read the instructional script to subjects as we went through the computerized instructional slides. When the subject began practice the experimenter got up from the table and left the vicinity of the workstation. Once the subject indicated they had completed the practice the experimenter returned to explain how their payment would be realized in the actual experiment. Subjects were then asked if they had any questions. Experiments were always script files that were distinct from the Instruction/Practice scripts. This was done to clarify the distinction between the instructions/practice phase (which did not count for actual payment) and the choice phase (which counted for actual payment). Subjects then began the experiment and again the experimenter got up from the table and left the vicinity. Once subjects indicated that they were done making choices the experimenter returned to determine which choice-situation counted for actual payment, to take the subject’s breathalyzer reading, to resolve any uncertainty (subjects rolled the die for those experiments with lotteries), and to have the subject sign a receipt for their payment (subjects were informed again at this stage the their signature did not need to be legible).

A.1 Measurement of Blood Alcohol Concentration

One possible criticism of our measurements of BAC is that we measured *breath* alcohol concentrations (BrAC). While it would be ideal to directly measure BAC this would have required blood sampling and existing data suggests this is unnecessary (O’Daire, 2009). All breath alcohol meters measure the concentration of alcohol in breath and multiply this number by a temperature and humidity dependent proportion, called the partition ratio.¹ The partition ratio is assumed to be fixed across individuals. In fact, partition ratios have been shown to vary to some degree across subjects (Fitzgerald & Hume, 1987).² The overall effect is that this natural variation can lead to mismeasurement by as much as 0.030 percentage points. While it is important to consider this potential for error in our measurement, we note that the drunk-driving evidentiary standards in many U.S. states are drafted in terms of blood alcohol concentration as measured by blood, urine, saliva, or breath, using commonly accepted measurement standards such as the breath alcohol meter we use here; (O’Daire, 2009).

¹With all US-DOT approved BAC meters the partition ratio is calibrated before each measurement to account for temperature and humidity.

²The standard partition ratio of 2100:1 is based on an internal body temperature of 98.6 degrees Fahrenheit and standard assumptions about blood hemoglobin concentrations. Variation in both internal body temperature and blood hemoglobin concentrations are the principal causes for variation in partition ratios.

B GARP Experiment

To calculate Afriat’s Efficiency Index and Houtman-Maks Index we first identify whether choices in our experiment depart from GARP. We follow the notation outlined by Varian (1982). However, instead of employing Warshall’s algorithm for calculating the transitive closure of a graph we use the computationally more intensive (but easier to program) method of inferring the transitive closure by multiplying the directly revealed preferred graph by itself 11 times. For the 11 prices in our experiment, (p^1, \dots, p^{11}) and each participant’s choices (x^1, \dots, x^{11}) , we construct an 11 by 11 matrix M (the directly revealed graph) whose ij^{th} entry is given by

$$m_{ij} = \begin{cases} 1 & \text{if } p^i x^i \geq p^i x^j \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

We then construct the indirectly revealed preferred graph MT (i.e. the transitive closure of M) whose ij^{th} entry is given by

$$mt_{ij} = \begin{cases} 1 & \text{if } m_{ij}^{11} > 0 \\ 0 & \text{otherwise} \end{cases} \quad (2)$$

where m_{ij}^{11} is the ij^{th} entry of the matrix $M^{11} = MM \dots M$. If $mt_{ij} = 1$ and $p^j x^j > p^i x^i$ for some i and j there is a GARP violation.

Conditional on a set of choice data violating GARP we calculate Afriat’s Index as the largest number $e \in [0, 1]$ such that the condition “ $mt_{ij} = 1$ and $e * p^j x^j > p^i x^i$ ” is never satisfied for any i and j . Algorithmically, we start with $e = 1$ and continually decrement e by 0.001 to find the largest value.

To calculate Houtman-Maks, conditional on observing at least one violation of GARP, we take all subsets of the choice data of size 10 and check whether any of these are GARP compliant (with the above algorithm). If no subset of size 10 is GARP compliant we take all subsets of size 9 and check whether any of these subsets are GARP compliant. We proceed in such a manner until we find at least one subset of the data that is GARP compliant. The cardinality of that subset is the Houtman-Maks.

We calculated Afriat’s Index and Houtman-Maks for each participant using Matlab 7.8.0.347 (R2009a) on a MacBook Pro running OSX. Our code and data are available upon request.

B.1 Supplemental Analyses

B.1.1 Dependent Variable: Houtman-Maks

The scatter plot in Figure 1 shows all of the HM-BAC pairs for our sample. Table 2 reports the number of subjects and average BAC for each level of HM in our sample. Of our 101 subjects, 58.4% make no violations of GARP.

Because the Houtman-Maks measure is discrete we estimate Poisson models of the form:

$$(11 - HM_i) = \beta_0 + \beta_1 BAC_i + \beta_2 \mathbf{1}(Female)_i + \epsilon_i \quad (3)$$

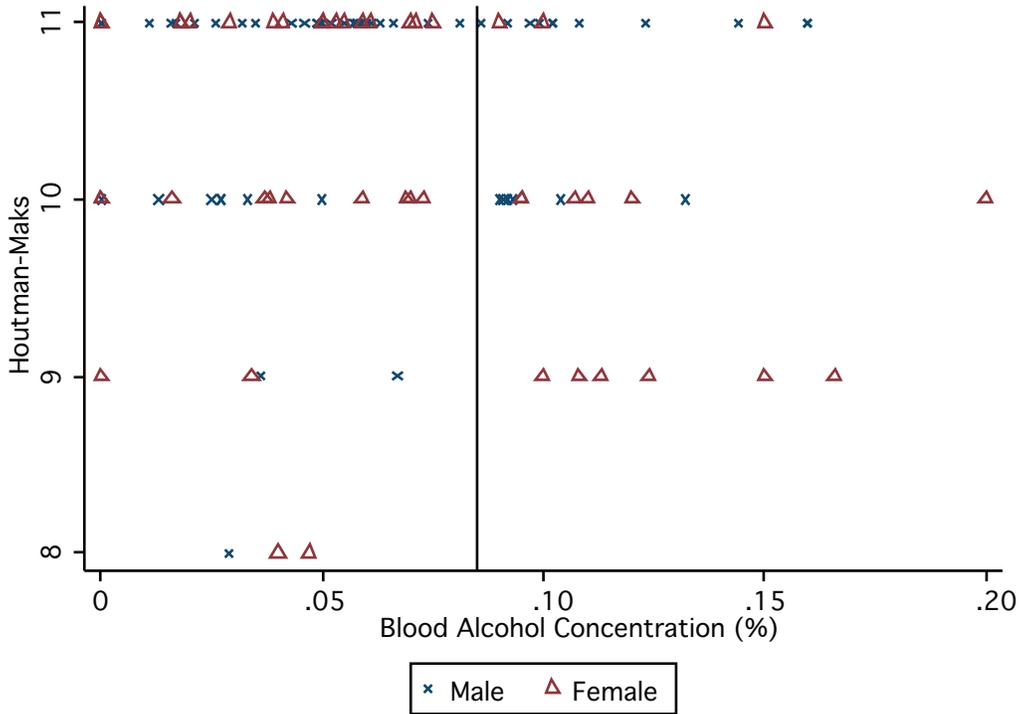
where HM_i is participant i ’s Houtman-Maks measure, BAC_i is their blood alcohol concentration, and $\mathbf{1}(Female)_i$ is an indicator variable. Note that the left-hand-side of our estimating specification subtracts each subject’s HM measure from 11. This is done to allow for the use of a standard estimation package (Stata SE, StataCorp LP, College Station, TX). Given this transformation, one would expect a positive relationship between BAC and (11-HM) if BAC compromises rationality.

Table 1: GARP Experiment Choice-Situation Details

Choice-Situation	p_1	p_2	w	Number of Alternatives	List of Alternatives
1	1	$\frac{1}{3}$	2	3	$\{(2, 0); (1, 3); (0, 6)\}$
2	1	$\frac{1}{2}$	3	4	$\{(3, 0); (2, 2); (1, 4); (0, 6)\}$
3	1	$\frac{1}{3}$	3	4	$\{(3, 0); (2, 3); (1, 6); (0, 9)\}$
4	1	1	4	5	$\{(4, 0); (3, 1); (2, 2); (1, 3); (0, 4)\}$
5	1	$\frac{1}{2}$	4	5	$\{(4, 0); (3, 2); (2, 4); (1, 6); (0, 8)\}$
6	1	1	5	6	$\{(5, 0); (4, 1); (3, 2); (2, 3); (1, 4)\}$
7	1	3	6	3	$\{(6, 0); (3, 1); (0, 2)\}$
8	1	2	6	4	$\{(6, 0); (4, 1); (2, 2); (0, 3)\}$
9	1	1	6	7	$\{(6, 0); (5, 1); (4, 2); (3, 3); (2, 4); (1, 5); (0, 6)\}$
10	1	2	8	5	$\{(8, 0); (6, 1); (4, 2); (2, 3); (0, 4)\}$
11	1	3	9	4	$\{(9, 0); (6, 1); (3, 2); (0, 3)\}$

Each participant faced the same 11 budgets over two distinct food-types of their own choosing: mini-pizzas, dumplings, grilled cheese sandwich with tomato (quarters), and sloppy-joe sliders.

Figure 1: Houtman-Maks and Blood Alcohol Concentration



The solid vertical line depicts 0.080% BAC, the legal driving limit in many U.S. states.

Model (1) through (4) in Table 3 report marginal effects from Poisson models. As in Table ??, the difference between models (1) and (2) (and (3) and (4)) is the inclusion of food-pairing controls in the estimating specification. The difference between (1)/(2) and (3)/(4) is the exclusion of three behavioral outliers.

As expected, Models (1) through (4) result in positive marginal effects for the relationship between BAC and HM. However, with the exception of Model (3), none of these marginal effects reaches traditional significance levels. Moreover, the effect-size in Model (3) is, relative to Models (1), (2), and (4), large and sensitive to the inclusion of food-pairing controls as in Model (4). However, considering this relatively large (marginal) effect size, a representative Male subject who is sober (BAC=0.000%) and has a Houtman-Maks of 11 would require a BAC of 0.487% to reduce their HM by one unit. This is a BAC that would generally be lethal to this representative agent.

Model (5) uses OLS to identify parameter estimates. Again, there does not appear to be a statistically reliable relationship between HM and BAC. Moreover, the effect sizes reported are similar in magnitude to the marginal effects reported for Poisson estimates: to induce an economically significant change in our dependent measure would require a BAC more than twice our highest recorded measurement and at a level that would likely result in death.

Tables 4 and 5 are supplemental analyses to those in the body of the paper. To assess for gender specific effects of alcohol on adherence to GARP we break out the estimates by gender and estimate only those models that include food controls. To make comparisons easier we follow the numbering scheme used in the body of the paper but append an “m” or an “f” for the male and female sub-samples, respectively. Focusing first on the male-only estimates in Table 4 we find no evidence of a statistical relationship between BAC and AEI.

Table 2: Houtman-Maks and BAC

Houtman-Maks	N	Avg. BAC	Std. Dev.
11	59	.060	.039
10	29	.066	.047
9	10	.090	.054
8	3	.039	.009
10.43 [†]	101	.064 [†]	.043 [†]

†: Sample Averages

For the GARP-AEI estimates in Table 4 we find at most weak evidence for a female-specific increase in the severity of GARP violations as BAC increases. However we urge a large degree of caution with any interpretation of these findings: First, for the female-only GARP-AEI regressions (Table 4), Stata's Tobit algorithm returns positive log-likelihoods (columns 2f and 4f) which casts doubt on the reliability of these estimates and their standard errors. For the OLS estimates (column 5f) the parameter estimate on BAC is not significant. Moreover, the implied effect size is not economically significant as it would require a female subject who starts out sober with an AEI of 1.00 to imbibe enough alcohol to arrive at a BAC of about 0.16% (twice the legal limit) to get below an AEI of 0.95. This BAC lies at the upper reaches of our estimating samples (only two women had measured BACs above this level, one of which had an AEI of 0.999). For the female-only GARP-HM estimates in Table 5, there appears to be some evidence for a statistically significant relationship between the frequency of violations (as measured by HM) and BAC, in females. But again we urge caution in interpreting these findings: The relatively large effect size for the OLS estimates in column 5f is not economically significant as it would require a woman who starts out sober with an HM of 11 to arrive at a BAC of 0.21% to make one violation, a BAC that lies comfortably outside of our estimating samples. Furthermore, the statistical significance (and effect size) of the parameter estimate in columns 4f and 5f are sensitive to the inclusion of five women in our sample with BACs above 0.12.

Table 3: Regressions demonstrating no relationship between Houtman-Maks (HM) and BAC

Variable	(1)	(2)	(3)	(4)	(5)
BAC	1.257 (1.280)	0.424 (1.178)	2.053* (1.097)	1.388 (1.098)	1.778 (1.737)
Female	0.452*** (0.153)	0.355** (0.149)	0.388*** (0.128)	0.318** (0.139)	0.340** (0.150)
Constant	-1.165*** (0.327)	-1.649*** (0.448)	-1.459*** (0.320)	-1.770*** (0.462)	0.058 (0.157)
Est. Type	Poisson	Poisson	Poisson	Poisson	OLS
Number Obs.	101	101	98	98	98
Log Likelihood	-97.4	-93.8	-84.7	-83.0	-
Pseudo R^2/R^2	0.049	0.084	0.058	0.076	0.158
Food Controls	No	Yes	No	Yes	Yes
Excl. Crit.	N.A.	N.A.	$HM_i \leq 8$	$HM_i \leq 8$	$HM_i \leq 8$

Notes: Marginal effects are reported for the BAC & Female variables in models 1-4. Standard errors of these marginal effects in parentheses, otherwise robust s.e.'s are reported. Significance at the 1% level is denoted ***, 5% as **, 10% as *.

B.2 GARP Experiment Instructions

The Instructions/Practice portion of the experiment was computerized in the experimental software E-Prime. Compiled Instructions/Practice and Experimental programs are available from the authors on request. The text read to each subject, on each slide in the Instruction/Practice portion of the experiment is detailed below:

1. This is an experiment about decision making. It is both Anonymous and Confidential. What I mean by anonymous is that I won't be collecting any personally identifying information. What I mean by confidential is that the choices you make today will only be looked at by researchers: we will not share any of the decisions you make today with the bar owners or management. At the end of the experiment you will receive food and \$10 in cash for your participation. You will need to sign a receipt for your payment but your signature does not need to be legible. I give that receipt to the NYU finance office to get reimbursed. During the experiment you are not allowed to eat or drink anything. The reason for this is because it would screw-up the breathalyzer reading you are going to take at the end of the experiment.
2. During the experiment you will select amongst "bundles" of food. Bundles are comprised of two parts: a quantity of mini-pizzas AND a quantity of dumplings. Please note that you will be able to select the two foods you want from a small menu before starting the experiment. But for the purposes of these instructions and practice we will use mini-pizzas and dumplings.
3. Here is an example of how bundles will be presented in the experiment. This bundle has 3 mini-

Table 4: Regressions demonstrating no relationship between Afriat's Efficiency Index (AEI) and BAC

Variable	(2m)	(2f)	(4m)	(4f)	(5m)	(5f)
BAC	0.894 (0.724)	-0.391 (0.346)	0.552 (0.477)	-0.521* (0.285)	0.155 (0.155)	-0.315 (0.190)
Constant	1.070*** (0.069)	1.121*** (0.055)	1.036*** (0.044)	1.100*** (0.042)	0.982*** (0.0114)	1.015*** (0.010)
Est. Type	Tobit	Tobit	Tobit	Tobit	OLS	OLS
Number Obs.	55	46	54	45	54	45
Censored Obs.	39	20	39	20	N.A.	N.A.
Log Likelihood	-9.33	5.70	-2.31	12.86	-	-
Pseudo R^2/R^2	0.217	0.508	0.313	Not Def.	0.415	0.214
Food Controls	Yes	Yes	Yes	Yes	Yes	Yes
Excl. Crit.	N.A.	N.A.	$AEI_i \leq 0.675$	$AEI_i \leq 0.675$	$AEI_i \leq 0.675$	$AEI_i \leq 0.675$

Notes: Robust standard errors in parentheses. Significance at the 1% level is denoted ***, 5% as **, 10% as *.

Table 5: Regression demonstrating no relationship between Houtman-Maks (HM) and BAC

Variable	(2m)	(2f)	(4m)	(4f)	(5m)	(5f)
BAC	-3.400 (2.166)	2.736 (1.856)	-2.761 (1.960)	3.746** (1.724)	-3.098 (2.393)	4.731* (2.575)
Constant	-0.794 (0.568)	-1.436** (0.637)	-0.836 (0.569)	-1.541** (0.650)	0.428** (0.187)	0.059 (0.059)
Est. Type	Poisson	Poisson	Poisson	Poisson	OLS	OLS
Number Obs.	55	46	54	44	54	44
Log Likelihood	-40.7	-50.6	-36.1	-44.3	-	-
Pseudo R^2/R^2	0.063	0.070	0.051	0.072	0.079	0.202
Food Controls	Yes	Yes	Yes	Yes	Yes	Yes
Excl. Crit.	N.A.	N.A.	$HM_i \leq 8$	$HM_i \leq 8$	$HM_i \leq 8$	$HM_i \leq 8$

Notes: Marginal effects are reported for the BAC & Female variables in models 1-4. Standard errors of these marginal effects in parentheses, otherwise robust s.e.'s are reported. Significance at the 1% level is denoted ***, 5% as **, 10% as *.

pizzas AND 2 dumplings.

4. Here is an example of a different bundle. This bundle has 2 mini-pizzas AND 4 dumplings.
5. In the experiment you will be presented with “lists” of bundles. The food you receive in the experiment will depend on what you pick from these lists. Your job is to pick the bundle you want MOST from each list.
6. Here is an example of a list of bundles. You indicate which bundle you want most from the list by using the mouse to check the box next to it.
7. Once you have checked the box next to the bundle you want most, click the Next button to go to the next list.
8. The lists are set up with a tradeoff between the two foods. So, for example, in this list you can have 8 dumplings and zero mini-pizzas. But, if you give up 2 dumplings, you can get one mini-pizza. If you give up 4 dumplings you can have 2 mini-pizzas. And, you can continue this until you have nothing but 4 mini-pizzas.
9. The food you receive will depend on what you pick from the lists. There are 11 lists in the experiment. You will only get the food from ONE of the 11 lists. But, you will get the bundle you selected from that list.
10. How do we determine the ONE list that counts for actual payment? First, you go through all 11 lists and indicate which bundle you want most from each list. Then, the computer picks ONE list randomly from the 11 you were shown. The computer will display that list and your choice and you will receive the bundle you picked from that list.
11. You don't know which list will count for actual payment. And you cannot change what you picked during the payment phase. So, your best strategy is to treat each list as though you are ACTUALLY going to get what you pick. Look over each bundle in the list. And pick the bundle you want most.
12. To make sure everything is clear you are going to do a short practice. The practice has only four lists and does NOT count for payment.
13. PRACTICE SLIDES
14. The computer will now select ONE of the four lists you just saw. The computer will display the list and indicate which bundle you picked.
15. The computer picked this list. You picked this bundle. If this was the actual experiment you would receive NN mini-pizzas and NN dumplings.
16. This is the end of practice. Do you have any questions?

C Independence Experiment

Table 6: Independence Experiment Choice-Situation-Pair Details

Label	Prizes (\$)	L'	L''	EV[L']	Var[L']	EV[L'']	Var[L'']
c-11	(10, 30, 35)	(.50, .30, .20)	(.25, .65, .10)	21.0	124	25.5	82.3
c-12	(15, 30, 40)	(.50, .30, .20)	(.25, .65, .10)	24.5	102	27.3	58.7
c-13	(10, 30, 45)	(.50, .20, .30)	(.25, .60, .15)	24.5	237	27.3	126
c-14	(15, 30, 40)	(.50, .20, .30)	(.25, .60, .15)	25.5	122	27.8	66.2
c-15	(10, 30, 55)	(.40, .40, .20)	(.20, .70, .10)	27.0	276	28.5	140
c-01	(10, 30, 35)	(.20, .40, .40)	(.10, .70, .20)	28.0	86.0	29.0	44.0
c-02	(25, 30, 35)	(.40, .10, .50)	(.20, .55, .25)	30.5	22.3	30.3	11.2
c-03	(20, 30, 40)	(.20, .10, .70)	(.10, .55, .35)	35.0	65.0	32.5	38.8
c-04	(20, 30, 40)	(.20, .20, .60)	(.10, .60, .30)	34.0	64.0	32.0	36.0
c-05	(20, 30, 50)	(.20, .50, .30)	(.10, .75, .15)	34.0	124	32.0	66.0
c-06	(15, 30, 70)	(.25, .50, .25)	(.125, .75, .125)	36.3	417	33.1	218
c-07	(25, 30, 45)	(.20, .20, .60)	(.10, .60, .30)	38.0	76.0	34.0	54.0
c-08	(10, 30, 50)	(.20, .20, .60)	(.10, .60, .30)	38.0	256	34.0	144
c-09	(20, 30, 50)	(.20, .10, .70)	(.10, .55, .35)	42.0	156	36.0	114
c-10	(20, 30, 65)	(.20, .20, .60)	(.10, .60, .30)	49.0	394	39.5	287

C.1 Testing for quasi-concavity in IAVs

To determine whether violations of independence are systematically in one direction or another (which reveals quasi-concavity or quasi-convexity of indifference curves in the simplex) Table 7 reports the proportion of IAVs in which the chooser violates by choosing L' over L (denoted $L' \succ^* L$) but then choosing L over L'' . The data are broken out by $BAC_i \geq 0.08\%$ and reported for three sub-samples as is done in the regressions reported in the main body of the paper.

The results from this analysis suggest that for most of the choice-situation-pairs (CSPs) in our experiment there is not sufficient evidence to indicate systematic violations of IA (i.e. no strong evidence for quasi-concavity or quasi-convexity). Furthermore, for the CSPs that indicate some systematic quasi-concavity (i.e. CSPs c-11 through c-15), all of these choice-situations involve participants selecting a lottery with an expected value that is less than the certain \$30 (see Table 15). This fact indicates some degree of caution in making any strong conclusions about these types of choices because the results from our risk experiment indicate that choosers tend to be risk averse in our experiment.

C.2 Supplementary Analyses

C.2.1 An Alternative Identification Strategy

As we highlighted in our background section, one of the predominant theories of how alcohol can influence behavior is “alcohol myopia” which proposes that alcohol makes responses to stimuli more extreme (Steele & Josephs, 1990). That is of particular concern in our study because it suggests that some or all of the precise lotteries we presented in our study may have evoked the responses they did not because of some general underlying property of our subjects but rather because of some very trial-specific properties of precise lotteries we employed. Indeed more broadly, evidence suggests that the way lotteries are presented to subjects can have significant impacts on conclusions about violations of the IA (Keller, 1985; Moskowitz, 1974). While it is difficult to be certain that trial-by-trial effects of alcohol myopia do not underlie our results with the IA, we attempted to address this issue by assessing whether our data show an increase in the likelihood that a subject will make an IAV, in any given choice-situation-pair, that is not well described by our overall model. The central notion here is that if some of the choice-situation-pairs elicit an alcohol-myopic response then responses on that particular question, while statistically related to blood alcohol concentration, differ from that predicted by the more general model that drives our analysis. To the extent that our data permit this analysis, we assessed this by estimating probit models of the following form:

$$\text{Prob}[IAV_{ij}] = \gamma_0 + \gamma_1 BAC_i + \gamma_2 \mathbf{1}(\text{Female})_i + \delta_j \mathbf{1}(j) + \eta_{ij} \quad (4)$$

Where IAV_{ij} is an indicator variable for whether participant i made an IAV in choice-situation-pair j . In addition to the standard BAC and Female variables, we include the set of 14 indicator variables that serve as controls for any choice-situation-pair attributes that could potentially effect the likelihood of an IAV. These are the $\delta_j \mathbf{1}(j)$ in equation 4 above.

Table 8 reports parameter estimates from five probit estimations. Model (1) includes data from our full sample of 104 participants (each with data from 15 choice-situation-pairs for a total of 1560 observations) but excludes the choice-situation-pair controls (i.e. the δ_j 's) while Model (2) includes these controls. In contrast to our estimates of the frequency of IAVs, here we find our parameter estimates to be statistically different than zero at the traditional 5% threshold. However, once again, the sizes of these effects, at an economic level, are not large. Consider the parameter estimate for BAC in Model (2) of Table 8 and a representative sober male: he would need to imbibe enough alcohol to arrive at

Table 7: Independence Axiom Violation rates used to demonstrate no systematic quasi-concavity or quasi-convexity

Proportion of IAVs with $L' \succ^* L \rightarrow L \succ^* L''$						
Label	$BAC_i < 0.08$	$BAC_i \geq 0.08$	$BAC_i < 0.08$	$BAC_i \geq 0.08$	$BAC_i < 0.08$	$BAC_i \geq 0.08$
c-11	0.00 [†]	0.06 [†]	0.00 [†]	0.06 [†]	0.00 [†]	0.08 [†]
c-12	0.20 [†]	0.09 [†]	0.21 [†]	0.00 [†]	0.27	0.00 [†]
c-13	0.06 [†]	0.13 [†]	0.06 [†]	0.07 [†]	0.00 [†]	0.07 [†]
c-14	0.00 [†]	0.17 [†]	0.00 [†]	0.10 [†]	0.00 [†]	0.00 [†]
c-15	0.06 [†]	0.25 [†]	0.06 [†]	0.27	0.03 [†]	0.31
c-01	0.22 [†]	0.36	0.24 [†]	0.42	0.20 [†]	0.36
c-02	0.14 [†]	0.56	0.14 [†]	0.53	0.16 [†]	0.62
c-03	0.60	0.50	0.64	0.42	0.62	0.50
c-04	0.73	0.58	0.71	0.60	0.69	0.56
c-05	0.44	0.42	0.50	0.40	0.57	0.43
c-06	0.33	0.46	0.33	0.45	0.33	0.33
c-07	0.45	0.65	0.50	0.65	0.50	0.64
c-08	0.56	0.42	0.60	0.45	0.57	0.40
c-09	0.67	0.78	0.67	0.75	0.64	0.83
c-10	0.71	0.57	0.67	0.57	0.60	0.50
Excl. Crit.	N.A.		$IAV_i > 7.5$		$FOSD_i < 80\%$	
			-		$IAV_i > 7.5$	

Notes: †Indicates quasi-concavity at 95% confidence (i.e. the proportion of violations is different than 0.5 using a t-test)

Notes: * Indicates quasi-convexity at 95% confidence (i.e. the proportion of violations is different than 0.5 using a t-test)

Figure 2: The Spectrum of Lottery Prizes and Colors Used in the Independence Experiment

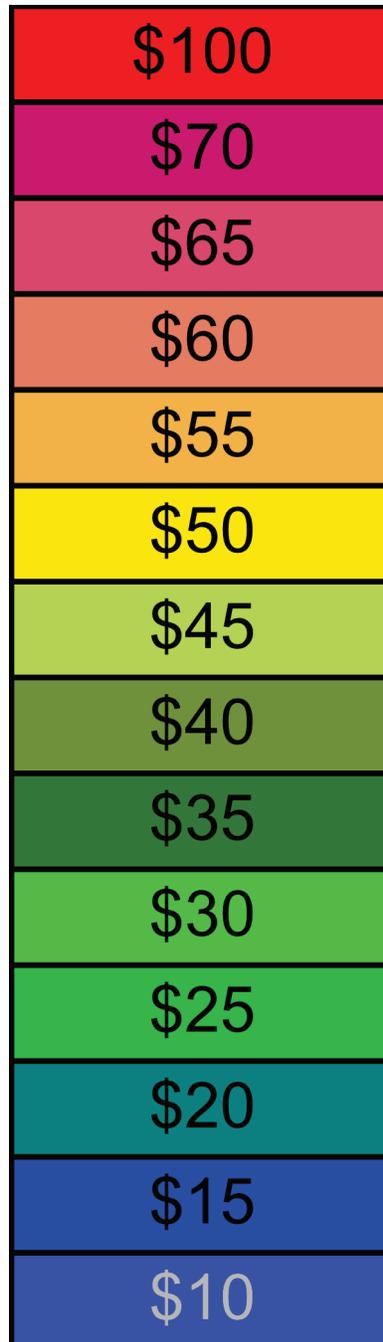


Table 8: Probits demonstrating a weak relationship between the likelihood of independence axiom violations (IAVs) and Blood Alcohol Concentration (BAC)

Variable	(1)	(2)	(3)	(4)	(5)
BAC	0.649** (0.291)	0.657** (0.292)	0.512* (0.295)	0.650** (0.320)	0.552* (0.323)
Female	0.049** (0.024)	0.051** (0.024)	0.053** (0.024)	0.047* (0.023)	0.054* (0.025)
Constant	-0.802*** (0.074)	-0.298*** (0.140)	-0.288** (0.142)	-0.271* (0.149)	-0.296** (0.151)
Est. Type	Probit	Probit	Probit	Probit	Probit
CS-Pair Controls	No	Yes	Yes	Yes	Yes
Number Obs.	1560	1560	1515	1380	1350
Log Likelihood	-920.8	-900.4	-858.6	-777.1	-748.3
Pseudo R^2	0.007	0.029	0.030	0.033	0.034
Excl. Crit.	N.A.	N.A.	$IAV_i > 7.5$ -	$FOSD_i < 80\%$ -	$FOSD_i < 80\%$ $IAV_i > 7.5$

Notes: Marginal effects are reported for the BAC & Female variables in models 1-5. Standard errors of these marginal effects in parentheses, otherwise robust s.e.'s are reported. Significance at the 1% level is denoted ***, 5% as **, 10% as *.

a BAC of 0.152% to increase the likelihood he makes IAVs by 10%, in any choice-situation-pair in our experiment. These results are consistent with findings from our regressions in section 5.3 above while, to the extent possible, controlling for the fact that alcohol may be inducing differential responses to our specific stimuli. So while one cannot, in a dataset like ours, rule out the possibility that alcohol myopia has an effect that is independent of the one our model captures, it is clear that our analysis fails to identify an independent effect of this kind.

As in the supplementary GARP analyses we report estimates for model specifications as outlined in the body of the paper but break them out by gender. For column headings we follow the same numberings scheme for the relevant table but append an “m” or an “f” to the model number for the male-only and female-only estimates, respectively.

For the OLS estimates in Table 9, none of the parameter estimates for BAC are significant at traditional levels. Also, the magnitude of these parameter estimates are similar to those reported in the mixed-gender regressions found in the body of the paper.

Table 9: Regressions demonstrating a weak relationship between the number of independence axiom violations (IAVs) and Blood Alcohol Concentration (BAC)

Variable	(1m)	(1f)	(3m)	(3f)	(4m)	(4f)
BAC	9.895 (7.681)	9.778 (6.650)	9.398 (7.977)	10.131 (7.423)	11.95 (7.791)	5.594 (6.650)
Constant	3.114*** (0.584)	3.848*** (0.528)	3.017*** (0.601)	3.634*** (0.565)	2.730*** (0.554)	3.884*** (0.519)
Est. Type	OLS	OLS	OLS	OLS	OLS	OLS
Number Obs.	44	60	39	53	38	52
R^2	0.036	0.048	0.030	0.052	0.059	0.019
Excl. Crit.	N.A. -	N.A. -	$FOSD_i < 80\%$ -	$FOSD_i < 80\%$ -	$FOSD_i < 80\%$ $IAV_i > 7.5$	$FOSD_i < 80\%$ $IAV_i > 7.5$

Notes: Robust standard errors in parentheses. Significance at the 1% level is denoted ***, 5% as **, 10% as *.

C.3 Independence Experiment Instructions

The Instructions/Practice portion of the experiment was computerized in the experimental software E-Prime. Compiled Instructions/Practice and Experimental programs are available from the authors on request. The text read to each subject, on each slide in the Instruction/Practice portion of the experiment is detailed below:

1. This is an experiment about decision making. It is completely anonymous and at the end you will be paid in cash. You will need to sign a receipt for your payment but your signature does not need to be legible. I give that receipt to the NYU finance office to get reimbursed. The people at the finance office do not know anything about the decisions you will be making. During the experiment you are not allowed to eat or drink anything. The reason for this is because it would screw-up the breathalyzer reading you are going to take at the end of the experiment.
2. Before starting the experiment we are going to go through some instructions and a practice. None of this is intended as a test and there are no right or wrong answers.
3. In the experiment you will be choosing between “lotteries.” The next few slides will explain what lotteries are and how they will be presented.
4. A lottery is a list of monetary prizes and the probability of getting each one. This lottery is pretty simple: it represents getting \$30 for sure.
5. Other lotteries are more complicated. This lottery has three possible prizes: \$55, \$35, and \$30.
6. All the lotteries in the experiment will be presented in a similar way. They will be a list of prizes and the probability of getting each of those prizes. Note that in this lottery, and every lottery in the experiment, the probabilities add up to 100%. So, there are no “hidden” prizes. They are all right there.

Table 10: Probits demonstrating a weak relationship between the likelihood of independence axiom violations (IAVs) and Blood Alcohol Concentration (BAC)

Variable	(2m)	(2f)	(4m)	(4f)	(5m)	(5f)
BAC	0.669 (0.433)	0.643 (0.392)	0.600 (0.471)	0.664 (0.426)	0.771* (0.464)	0.354 (0.433)
Constant	-0.240 (0.252)	-0.186 (0.184)	-0.140 (0.220)	-0.221 (0.197)	-0.213 (0.225)	-0.176 (0.199)
Est. Type	Probit	Probit	Probit	Probit	Probit	Probit
CS-Pair Controls	Yes	Yes	Yes	Yes	Yes	Yes
Number Obs.	660	900	585	795	570	780
Log Likelihood	-347.7	-543.2	-297.5	-468.2	-278.8	-454.7
Pseudo R^2	0.055	0.022	0.066	0.028	0.082	0.028
Excl. Crit.	N.A.	N.A.	$FOSD_i < 80\%$ -	$FOSD_i < 80\%$ -	$FOSD_i < 80\%$ $IAV_i > 7.5$	$FOSD_i < 80\%$ $IAV_i > 7.5$

Notes: Marginal effects are reported for the BAC & Female variables in models 1-5. Standard errors of these marginal effects in parentheses, otherwise robust s.e.'s are reported. Significance at the 1% level is denoted ***, 5% as **, 10% as *.

7. The prizes are always ordered so that the largest prize you can get is at the top. The smallest prize you can get is at the bottom.
8. The color also represent unique prize values. This lovely beige will always be associated with \$55. The bright green always \$30. Here is the spectrum of colors and prize values.
9. The sizes of the blocks are also proportional to the probabilities. So, the \$30 and \$35 block are the same size because the probabilities of getting each of those prizes is 30%. The \$55 block is slightly bigger because the probability of getting that prizes is 40%. I am going through all of this in such detail because there is a lot of information in each of the lotteries. And, it's presented in multiple ways. So, just use whichever is easiest for you to understand. Also, the lotteries are not misleading in any way. The colors won't change and the sizes of the blocks are not misleading. It's all right there.
10. To make sure you understand how the lotteries are presented I am going to ask you a couple of questions about THIS lottery [POINT AT THE LOTTERY ON THE SCREEN]. What is the most money you can get from this lottery? Which prize are you most likely to get? What is the probability of getting the smallest monetary amount?
11. Your payment depends on the decisions you make during the experiment. And now I'm going to explain how your decisions are linked to your payment.
12. All the choices in the experiment involve you selecting between \$30 for sure and a lottery with three possible prizes. The \$30 for sure will always be on the left and to select it you just check the box underneath it. The lottery with three possible prizes will always be on the right and to select it check the box underneath it. When you are ready to move on just check the "Next" button.
13. Suppose you had selected \$30 for sure in the previous choice-situation. Well, you would get \$30.

14. Suppose instead you selected the lottery with three possible prizes. To determine how much money you would get you will roll this 100-sided die. And, depending on the number that comes up, it will determine how much money you get. To read the 100-sided die the number on the outside is the tens-digit, and the number on the inside is the ones-digit. [ROLL DIE]. So, for example, this is [SAY THE NUMBER THAT IS ROLLED]. For this lottery, if you roll a 01-40 you would get \$55. If you roll a 41-70 you would get \$35. If you roll 71-100 you would get \$30. Please note that for our die 100 is denoted by 0-0.
15. In the actual experiment you are going to make several choices. And you will only receive payment from ONE of the choices. But, you will get what you selected. If you selected the \$30 for sure you would get \$30. If you selected the lottery with three possible prizes you will roll the die to determine how much money you get.
16. How is the choice that counts for actual payment determined? First, you will go through all of the choices and indicate whether you want the \$30 for sure or the lottery with three possible prizes. Once you are done the computer will randomly pick one of those choices from the entire set you have been shown. The computer will display the choice and what you picked. And you will get what you picked.
17. You don't know which choice will count for actual payment. And you cannot change what you picked during the payment phase.
18. So, your best strategy is to look over both lotteries, treat each choice as though it counts for actual payment. And pick the option you want most.
19. To make sure everything is clear you are going to do a short practice. The practice has only four choices and does NOT count for payment. Remember that this is not a test and that there are no right or wrong answers.
20. PRACTICE SLIDES
21. The computer will now randomly select one of the four choices you just saw and show what you picked. If this was the actual experiment it would count for payment.
22. The computer selected this choice and you picked [\$30 for sure / the lottery]. If this was the actual experiment you would [get \$30 / roll the die to determine your payment].
23. This is the end of the practice. Any questions?

D Risk Experiment

To construct our log likelihood function we sum over the log of the individual-choice-situation probabilities multiplied by an indicator variable that is equal to unity when the relevant alternative was selected by a participant (the i 's) in one of the 40 choice-situations (the j 's), and zero otherwise. Mathematically, we have the following maximization problem:

$$\text{Max}_{\vec{\theta}} \sum_{i=1}^N \sum_{j=1}^{40} \mathbf{1}(safe)_{ij} \ln\{\text{Prob}[safe]_{ij}\} + \mathbf{1}(risky)_{ij} \ln\{\text{Prob}[risky]_{ij}\} \quad (5)$$

Where $\mathbf{1}(safe)_{ij}$ and $\mathbf{1}(risky)_{ij}$ are the aforementioned indicator variables, and the choice probabilities, denoted $\text{Prob}[\cdot]_{ij}$, are the choice probabilities detailed in the body of the paper.

The unknown, systematically varying, CRRA parameters (i.e. the vector $\vec{\theta}$) are estimated with conventional maximum likelihood methods. However, because the problem is non-standard the parameters cannot be estimated using packaged econometric software. We maximize our log-likelihood functions using Matlab 7.8.0.347 (R2009a) on a MacBook Pro running OSX. Optimization uses numeric derivatives and the BFGS algorithm. However, we recalculate the full Hessian matrix at the optimum using Greene's formulae. Asymptotic t-test statistics are based on a symmetrized version of the Hessian, where the off-diagonal elements of the numeric Hessian, if different, are averaged.

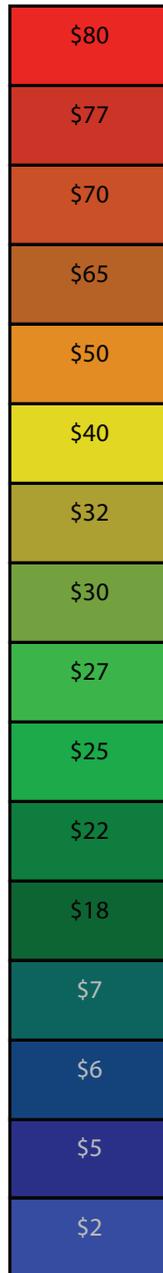
Table 11: Risk Experiment Choice-Situation Details

Choice-Situation	Prize Space <i>Safe</i>	Prize Space <i>Risky</i>	L_{safe} & L_{risky}	$EV[L_{safe}]$	$EV[L_{risky}]$
1	{32, 40}	{2, 77}	(0.90, 0.10)	32.8	9.5
2	{32, 40}	{2, 77}	(0.80, 0.20)	33.6	17.0
3	{32, 40}	{2, 77}	(0.70, 0.30)	34.4	24.5
4	{32, 40}	{2, 77}	(0.60, 0.40)	35.2	32.0
5	{32, 40}	{2, 77}	(0.50, 0.50)	36.0	39.5
6	{32, 40}	{2, 77}	(0.40, 0.60)	36.8	47.0
7	{32, 40}	{2, 77}	(0.30, 0.70)	37.6	54.5
8	{32, 40}	{2, 77}	(0.20, 0.80)	38.4	62.0
9	{32, 40}	{2, 77}	(0.10, 0.90)	39.2	69.5
10	{32, 40}	{2, 77}	(0.00, 1.00)	40.0	77.0
11	{22, 30}	{5, 70}	(0.90, 0.10)	22.8	11.5
12	{22, 30}	{5, 70}	(0.80, 0.20)	23.6	18.0
13	{22, 30}	{5, 70}	(0.70, 0.30)	24.4	24.5
14	{22, 30}	{5, 70}	(0.60, 0.40)	25.2	31.0
15	{22, 30}	{5, 70}	(0.50, 0.50)	26.0	37.5
16	{22, 30}	{5, 70}	(0.40, 0.60)	26.8	44.0
17	{22, 30}	{5, 70}	(0.30, 0.70)	27.6	50.5
18	{22, 30}	{5, 70}	(0.20, 0.80)	28.4	57.0
19	{22, 30}	{5, 70}	(0.10, 0.90)	29.2	63.5
20	{22, 30}	{5, 70}	(0.00, 1.00)	30.0	70.0

Table 12: Risk Experiment Choice-Situation Details, Continued

Choice-Situation	Prize Space <i>Safe</i>	Prize Space <i>Risky</i>	L_{safe} & L_{risky}	$EV[L_{safe}]$	$EV[L_{risky}]$
21	{25, 50}	{6, 80}	(0.90, 0.10)	27.5	13.4
22	{25, 50}	{6, 80}	(0.80, 0.20)	30.0	20.8
23	{25, 50}	{6, 80}	(0.70, 0.30)	32.5	28.2
24	{25, 50}	{6, 80}	(0.60, 0.40)	35.0	35.6
25	{25, 50}	{6, 80}	(0.50, 0.50)	37.5	43.0
26	{25, 50}	{6, 80}	(0.40, 0.60)	40.0	50.4
27	{25, 50}	{6, 80}	(0.30, 0.70)	42.5	57.8
28	{25, 50}	{6, 80}	(0.20, 0.80)	45.0	65.2
29	{25, 50}	{6, 80}	(0.10, 0.90)	47.5	72.6
30	{25, 50}	{6, 80}	(0.00, 1.00)	50.0	80.0
31	{18, 27}	{7, 65}	(0.90, 0.10)	18.9	12.8
32	{18, 27}	{7, 65}	(0.80, 0.20)	19.8	18.6
33	{18, 27}	{7, 65}	(0.70, 0.30)	20.7	24.4
34	{18, 27}	{7, 65}	(0.60, 0.40)	21.6	30.2
35	{18, 27}	{7, 65}	(0.50, 0.50)	22.5	36.0
36	{18, 27}	{7, 65}	(0.40, 0.60)	23.4	41.8
37	{18, 27}	{7, 65}	(0.30, 0.70)	24.3	47.6
38	{18, 27}	{7, 65}	(0.20, 0.80)	25.2	53.4
39	{18, 27}	{7, 65}	(0.10, 0.90)	26.1	59.2
40	{18, 27}	{7, 65}	(0.00, 1.00)	27.0	65.0

Figure 3: The Spectrum of Lottery Prizes and Colors Used in the Risk Experiment



D.1 Risk Experiment Instructions

The Instructions/Practice portion of the experiment was computerized in the experimental software E-Prime. Compiled Instructions/Practice and Experimental programs are available from the authors on request. The text read to each subject, on each slide in the Instruction/Practice portion of the experiment is detailed below:

1. This is an experiment about decision making. It is completely anonymous and at the end you will be paid in cash. You will need to sign a receipt for your payment but your signature does not need to be legible. I give that receipt to the NYU finance office to get reimbursed. The people at the finance office do not know anything about the decisions you will be making. During the experiment you are not allowed to eat or drink anything. The reason for this is because it would screw-up the breathalyzer reading you are going to take at the end of the experiment.
2. Before starting the experiment we are going to go through some instructions and a practice. None of this is intended as a test and there are no right or wrong answers.
3. In the experiment you will be choosing between “lotteries.” The next few slides will explain what lotteries are and how they will be presented.
4. A lottery is a list of monetary prizes and the probability of getting each one. This lottery is pretty simple: it represents getting \$40 for sure.
5. Other lotteries are slightly more complicated. This lottery has two possible prizes. You can either get \$80 or \$6. You have a 40% chance of getting \$80 and 60% chance of getting \$6.
6. All the lotteries in the experiment will be presented in a similar way. The prizes will always be inside the boxes and the probability of getting that prize will be to the right of it. The probabilities for a lottery will always add up to 100%.
7. The most you can get from a lottery will always be presented on top and the least at the bottom.
8. Colors also represent unique prizes. Here is a picture of the entire spectrum of possible prizes and the colors associated with them.
9. The sizes of the blocks in a lottery are also proportional to the probabilities. Note that the box representing the 40% is smaller than the box representing 60%. I am going through all of this in such detail because there is a lot of information in each of the lotteries. And, it’s presented in multiple ways. So, just use whichever is easiest for you to understand. Also, the lotteries are not misleading in any way. The colors won’t change and the sizes of the blocks are not misleading. It’s all right there.
10. To make sure you understand how the lotteries are presented I am going to ask you a couple of questions about THIS lottery [POINT AT THE LOTTERY ON THE SCREEN]. Which prize are you most likely to get? What is the probability of getting the smallest monetary amount?
11. Your payment depends on the decisions you make in the experiment. The next few slides will explain how your decisions are linked to your payment.
12. All of your choices will involve selecting between a pair of lotteries. In this choice you can either choose the lottery that has a 70% chance of getting \$27 and a 30% chance of getting \$18. Or, you can choose this lottery that has a 70% chance of getting \$65 and a 30% chance of getting \$7.
13. Suppose you selected the lottery on the left with a 70% chance of getting \$27 and a 30% chance of getting \$18. To determine how much money you get from this lottery you will roll a 10-sided die [SHOW THE SUBJECT THE DIE]. If you roll a 1 through 7, representing the 70% probability,

you would receive \$27. If you roll 8 through 10, representing the 30% probability, you would receive \$18.

14. Suppose instead that you selected the lottery on the right with a 70% chance of getting \$65 and a 30% chance of getting \$7. You would roll the 10-sided die to determine how much money you get. If you roll a 1 through 7, representing the 70% probability, you would get \$65. If you roll an 8 through 10, representing the 30% probability, you would get \$7.
15. In the actual experiment there will be several pairs of lotteries. You will receive payment from only one of those pairs. But, you will get the lottery you selected from that pair.
16. How is the pair that counts for actual payment determined? First you will go through the full set of pairs and indicate which lottery you want most. Then the computer will randomly select one of the pairs to count for actual payment. The computer will display the pair and show which lottery you picked.
17. You don't know what pair of lotteries the computer will pick to count for actual payment. And you cannot change the lottery you selected during the payment phase.
18. So, your best strategy is to look closely at both lotteries in a pair, treat each pair as though it counts for actual payment and pick the lottery you want most.
19. To make sure everything is clear you are going to do a short practice. The practice has only five choices and does NOT count for payment. Remember that this is not a test and that there are no right or wrong answers.
20. PRACTICE SLIDES
21. The computer will now randomly select one of the four choices you just saw and show what you picked. If this was the actual experiment it would count for payment.
22. The computer selected this choice and you picked [DESCRIBE THE SELECTED LOTTERY]. If this were the actual experiment you would roll the 10-sided die to determine your payment [EXPLAIN HOW THE NUMBERS RELATE TO THE PRIZES].
23. This is the end of the practice. Any questions?

E Consent Documents

To participate, potential subjects were required to answer four of the following five questions correctly about the consent form:

1. **True or False:** Your participation in this experiment is voluntary
2. What is the most you can be paid in this experiment? The least?
3. **True or False:** We will collect your name and match it with the responses you provide in the experiment
4. What is the blood alcohol concentration at which the State of New York considers drivers to be intoxicated?
5. What is the web address of the National Institute of Alcohol Abuse and Alcoholism (NIAAA), a website where you can learn more about the effects of alcohol and about alcohol abuse and alcoholism?

Figure 4: First page of the consent form



New York University
A private university in the public service
Center for Neural Science
4 Washington Place, Room 809
New York, NY 10003
Telephone: (212) 998-3904
Fax: (212) 995-4011
Email: glimcher@cns.nyu.edu



CONSENT FORM

Introduction

You have been invited to take part in a study to learn more about decision making. This study is directed by Dan Burghart, Ph.D. who is working under the supervision of Paul Glimcher, a full time faculty member in the Center for Neural science at New York University.

You must be 21 years or older to participate in this study.

Procedure

If you agree to take part in the study, you will be asked to do the following:

- View visual stimuli and make choices by pressing a button, or with a pen.
- Blow into a breath alcohol meter, like those used by law enforcement agencies.

Taking part in this study involves 1 experimental session lasting 1 hour. Participation in this study is completely voluntary, and you may choose to withdraw at any time.

Risks

There are no known risks associated with subjects' participation in this research beyond those associated with working at a computer terminal for a period of about 1 hour. If you think that you have experienced a research-related injury contact Dan Burghart, dan.burghart@nyu.edu, (212) 998-3904, or Professor Paul Glimcher, (212) 998-3904, glimcher@cns.nyu.edu.

Benefits

You will receive no direct benefits from participation in this study. However, this research may contribute to our understanding of the consistency of choices by intoxicated individuals.

Cost and Compensation

You will be paid for your participation. Your payment will depend partly on the choices you make and partly by a randomly determined number. The experiment is structured so that you cannot be paid less than \$2 or more than \$100. Should you withdraw before the end of the study, partial payment will be given. There will be no cost to you associated with participation in this study.

Figure 5: Second page of the consent form

Rights

Participation in this study is voluntary. You may refuse to participate or withdraw at any time without penalty. Nonparticipation or withdrawal will not affect your grades or academic standing.

If there is anything about the study or your participation that is unclear or that you do not understand, or if you have questions or wish to report a research-related problem, you may contact Dan Burghart, dan.burghart@nyu.edu, (212) 998-3904, 4 Washington Place, Room 809, New York, NY 10003 or the faculty sponsor, Paul Glimcher, at (212) 998-3904, glimcher@cns.nyu.edu, 4 Washington Place, Room 809, New York, NY 10003.

For more information or questions about your rights as a research participant, or if you are not satisfied with the manner in which this study is being carried out, you may contact the University Committee on Activities Involving Human Subjects (UCAIHS), 665 Broadway, Suite 804, New York, NY 10012, (212) 998-4808 or human.subjects@nyu.edu.

Anonymity & Confidentiality

Because names or personal information that can be used to identify you will not be collected during this experiment, all data are completely anonymous. In addition, confidentiality of the research records will be strictly maintained. Information will be stored in the investigator's file under lock and key and on a computer with password protection. All data will be identified with a code number and, because all data are collected anonymously, a code key connecting your name to specific information about you will never exist.

The results of this study may be published in a book or journal or used for teaching purposes.

Blood Alcohol, Health, and Law

Your blood alcohol level will be measured using a breath alcohol meter similar to one used by law enforcement agencies. According to the National Institutes of Health, individuals exhibiting blood alcohol concentrations above 0.10% experience reduced reaction times, loss of balance, impaired movement, slowed speech, and are at increased risk for alcohol abuse and alcoholism. If you want to learn more about the effects of alcohol, alcohol abuse, and alcoholism, visit the National Institute on Alcohol Abuse and Alcoholism's website at <http://www.niaaa.nih.gov>.

The State of New York considers drivers with a measured blood alcohol content above 0.08% to be intoxicated. Drivers with blood alcohol levels above 0.15% are also subject to enhanced penalties.

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