Paper Review:
Contingent Thinking and the Sure-Thing Principle : Revisiting Classic Anomalies in the Laboratory

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The Paradox of Ellsberg Problem

There is an urn with 90 balls, 30 of which are red (R) and 60 of which are yellow (Y) or blue (B), and one ball is selected from the urn and its color is used to determine the payoff.

Now subjects have two payoff options:

$$f = \begin{cases} 10 \; if \; R \; or \; B \\ 0 \; if \; Y \end{cases} \qquad g = \begin{cases} 10 \; if \; Y \; or \; B \\ 0 \; if \; R \end{cases}$$

Majority of people will prefer g over f.

The Paradox of Ellsberg Problem

- Now we consider "*Sure-Thing Principal(STP)*".

Suppose $\Omega = \{All\ Possible\ States\}, \Omega = A \cup A^c$,

$if\ g \gtrsim f\ if\ state \subseteq A\ and\ g \gtrsim f\ if\ state \subseteq A^c$, then choosing f.

- Add a further constrain, such preference should not depend on specific payoff, then we have *Savage's P2 as Separability (SEP)*.

The Paradox of Ellsberg Problem

Now,

$f' =$

		A		A^c
		R	Y	B
Question 1	f	\$10	\$0	\$10
	g	\$0	\$10	\$10
Question 2	f'	\$10	\$0	\$0
	g'	\$0	\$10	\$0

Figure 1: Example - Ellsberg problem (ELLS)

The Paradox of Ellsberg Problem

- Majority of people prefer g over f at Q1 but prefer f’ over g’ at Q2.
- Economist attributed the violation of SEP to non-standard preference.
- Psychologists(Nickerson, 2015) argued that hypothetical (contingent) thinking is challenging (i.e. people may have difficulty putting themselves in situations that have not occurred). (i.e. STP fails)

Five Problems

- Ellsberg(ELLS) – The violation of SEP.
- Common-Consequence Allais(CC ALLAIS) – The violation of SEP.
- Auction(AUCT) – The violation of dominance.
- Common-Value Election(ELECT) – the violation of dominance.
- Common-Ratio Allais(CR ALLAIS) – the violation of dominance.

Experimental Design

- Conduct two treatments in every problem:

  Noncontingent treatment

  Contingent treatment – ask subject to think in hypothetical way.

- Two effects:

  Highlighting the payoff structure of the problem.

  Asking subjects to put themselves in hypothetical position.

Treatments

- Between-subjects design

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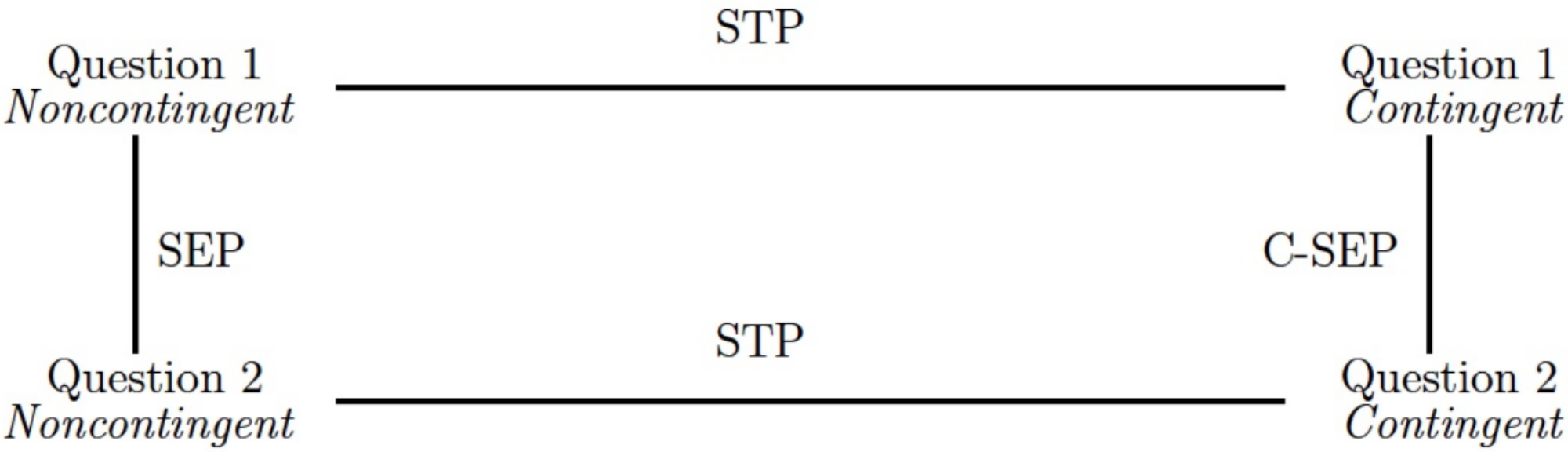

Figure 4: Experimental design and tests of STP, SEP, and C-SEP.

Only inform subjects of payoff structure.

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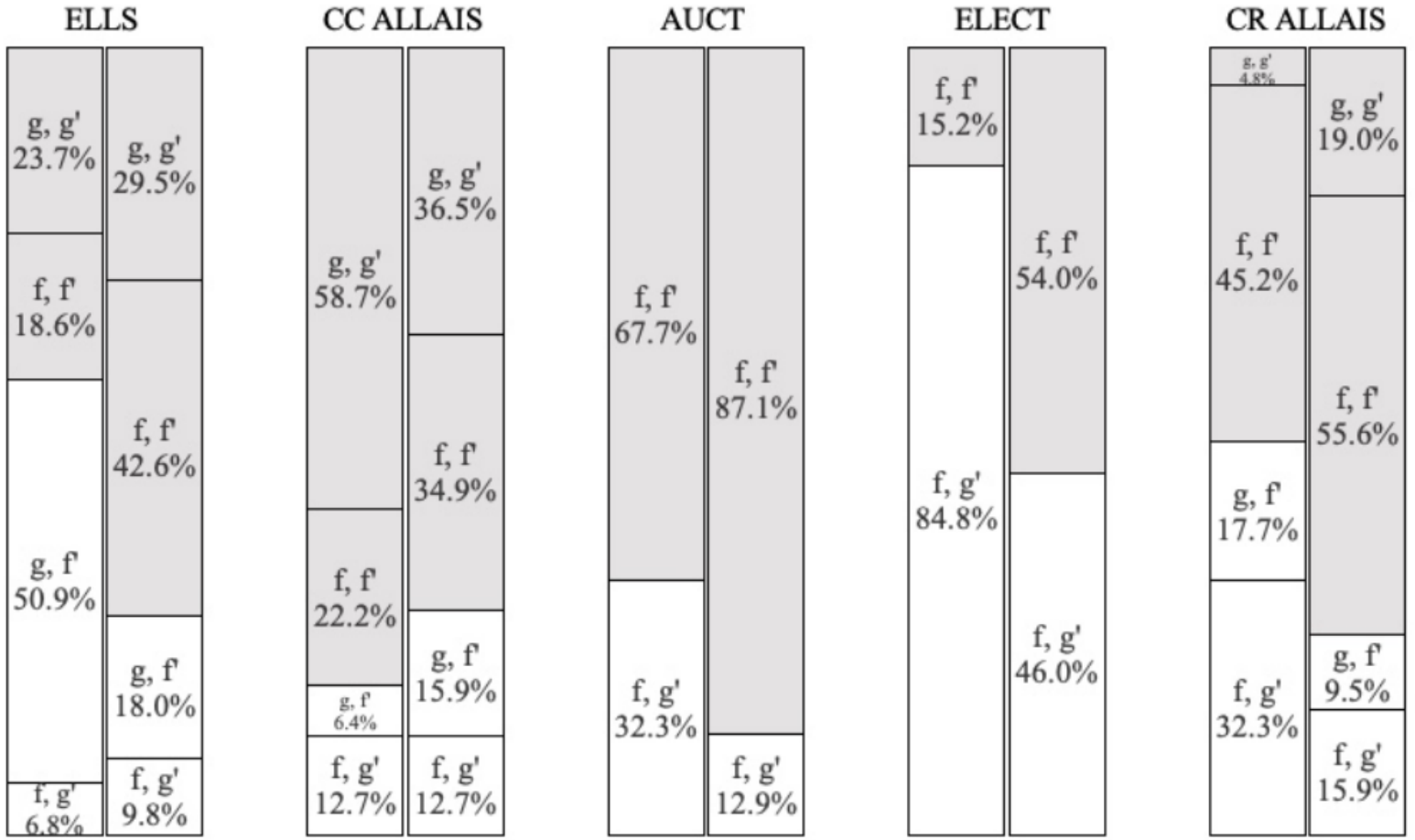

Treatment	NC	C	NC	C	NC	C	NC	C	NC	C
# of observations	59	61	63	63	62	62	66	63	62	63
% fail SEP/C-SEP	57.7%	27.8%	19.1%	28.6%	-	-	-	-	-	-
% fail DOM/C-DOM	-	-	-	-	32.3%	12.9%	84.8%	46.0%	50.0%	25.4%
p-value	0.001		0.258		0.011		0.000		0.001	

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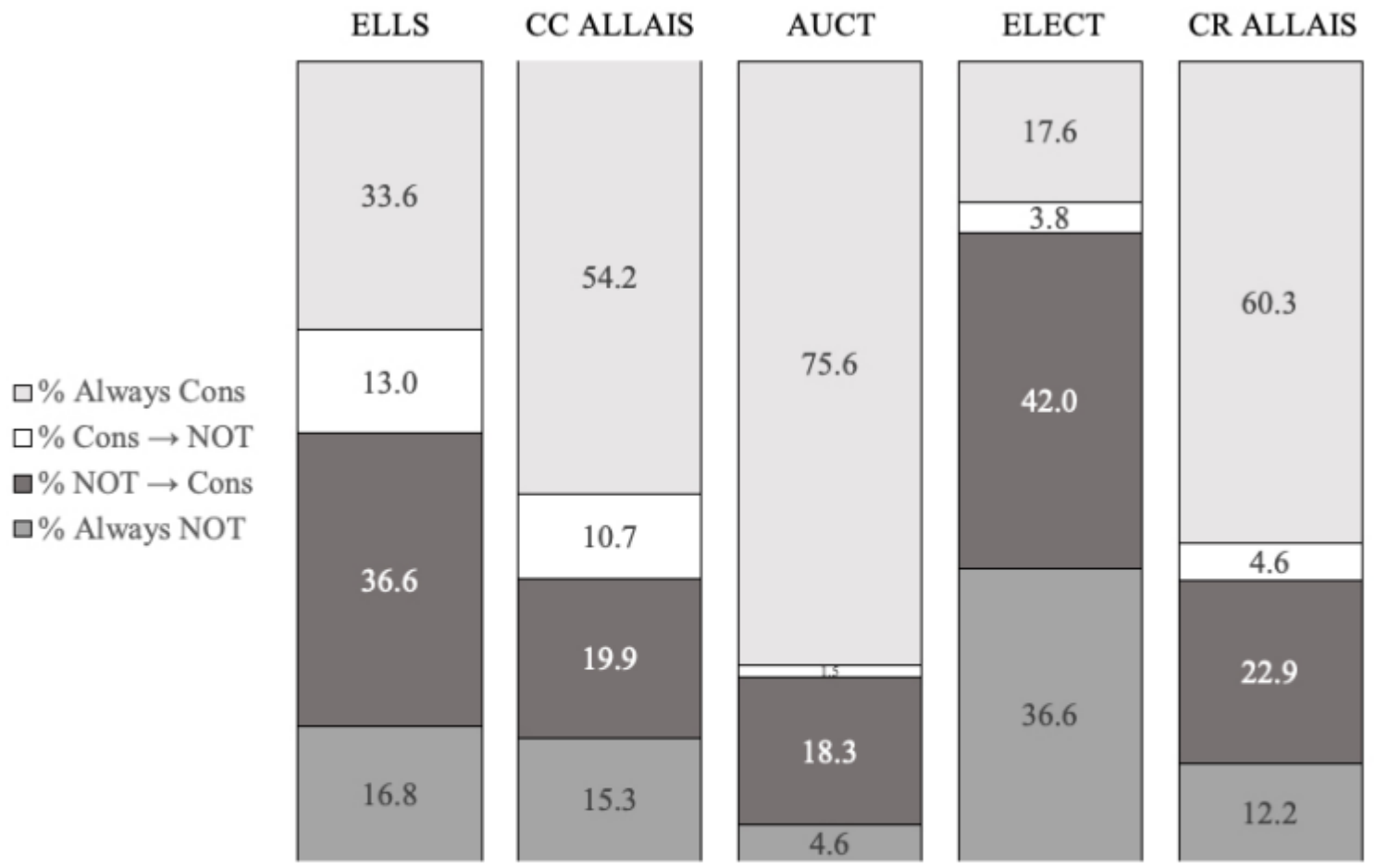


	ELLS	CC ALLAIS	AUCT	ELECT	CR ALLAIS
% fail SEP/DOM	53.4	35.1	22.9	78.6	35.1
% fail C-SEP/C-DOM	29.8	25.9	6.1	40.5	16.8
(▲) p-value	0.000	0.058	0.000	0.000	0.000
% fail STP	72.5	43.5	19.9	45.8	25.2
$q_{C\|I}$	0.69	0.57	0.80	0.53	0.65
$q_{I\|C}$	0.28	0.16	0.02	0.18	0.07
(⊗) p-value	0.000	0.000	0.000	0.000	0.000

Figure 7: *Within* design: summary of results

Results

‘

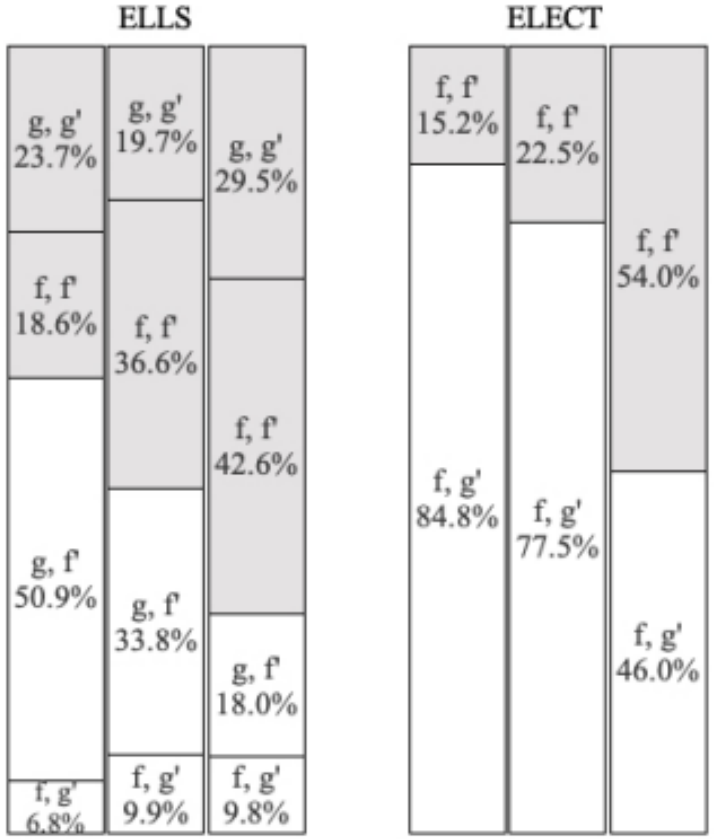
	ELLS	CC ALLAIS	AUCT	ELECT	CR ALLAIS
ELLS	—	*-.560* **.482****	*-.006* **-.060**	*.111* **-.030**	*.298* **.086**
CC ALLAIS	—	—	*.254* **-.070**	*-.250* **.047**	*-.248* **.692*****
AUCT	—	—	—	*.198** **.419*****	*.006* **.415*****
ELECT	—	—	—	—	*-.429* **.389****
CR ALLAIS	—	—	—	—	—

Table 1: Correlations across problems

Results

- Recall: Conti
- Auxiliary(Au
  not asking su

problem but
position.



Treatment	NC	Aux	C	NC	Aux	C
# of observations	59	71	61	66	71	63
% fail SEP postulate	57.7%	43.7%	27.8%	-	-	-
% fail DOM postulate	-	-		84.8%	77.5%	46.0%
p-value NC v. Aux	0.215			0.279		
p-value Aux v. C		0.024			0.000	

Figure 8: Aux frame vs. contingent & noncontingent frames

Conclusion

- The failure of SEP and DOM(Classic Anomalies) can be attributed to failure of contingent thinking (STP fails).

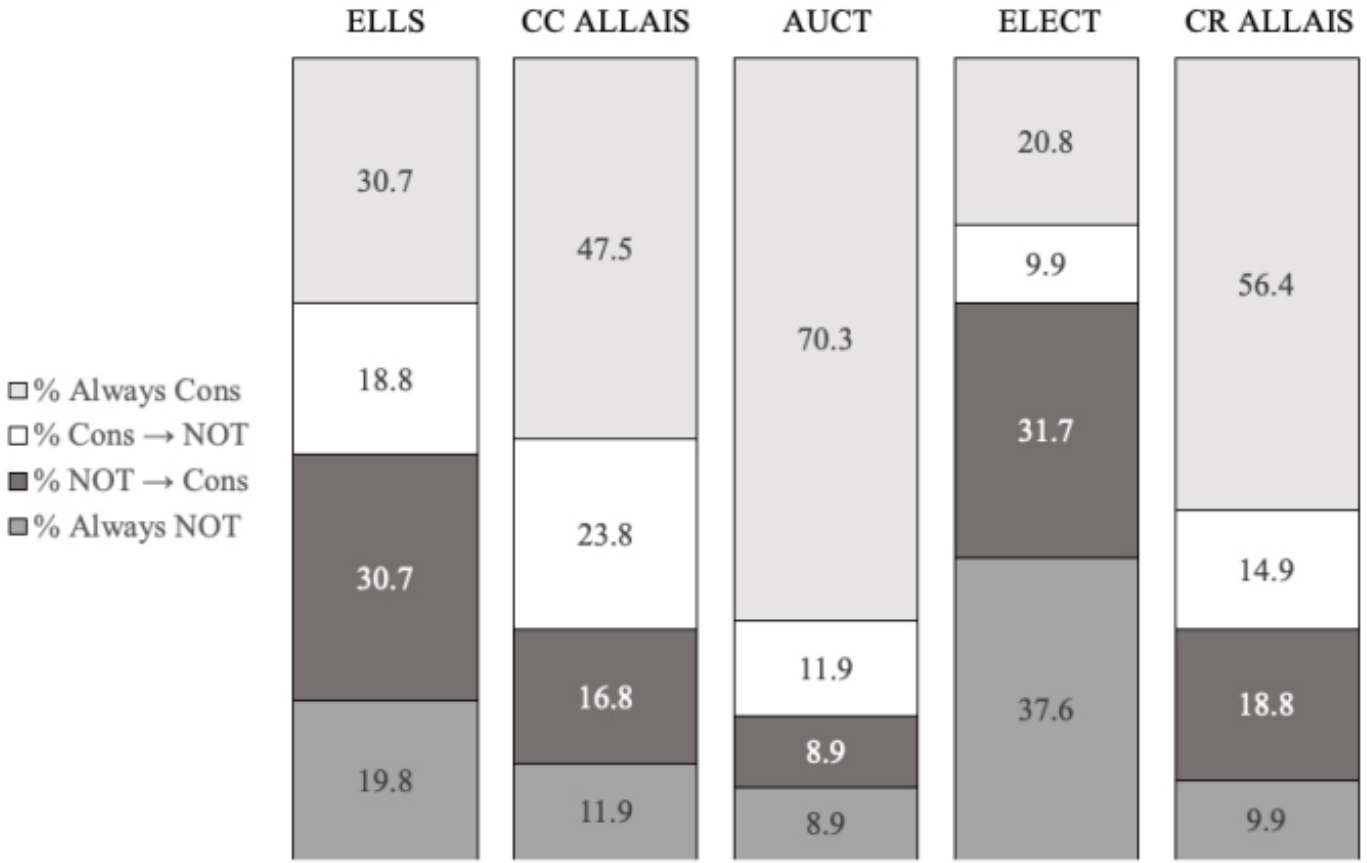
Possible Reasons:

- People have difficulty with contingent thinking
- Prefer not to engage with contingent thinking

	ELLS		CC ALLAIS		AUCT		ELECT		CR ALLAIS	
	Benchmark	All	Benchmark	All	Benchmark	All	Benchmark	All	Benchmark	All
% Always Cons	26.9	23.7	42.9	46.2	47.9	49.6	13.4	24.1	51.3	47.5
% Cons → NOT	16.8	16.5	21.0	13.7	10.9	11.3	2.5	2.6	10.9	14.1
% NOT → Cons	35.3	35.0	22.7	25.5	21.9	23.0	24.4	19.4	25.2	25.2
% Always NOT	21.0	24.9	13.5	14.6	19.3	16.1	59.7	53.8	12.6	13.2
% fail SEP or DOM	56.3	59.8	36.1	41.7	41.2	39.2	84.0	73.2	37.8	38.4
% fail C-SEP or C-DOM	37.8	41.3	34.4	28.3	30.2	27.4	62.2	56.4	23.5	27.3
p-value	.001	.000	.762	.001	.049	.000	.000	.000	.010	.000
% fail STP	66.4	69.9	49.6	49.9	32.8	34.3	26.9	22.1	31.9	36.1
$q_{C\|I}$	.63	.58	.63	.64	.53	.58	.29	.27	.67	.66
$q_{I\|C}$	.38	.42	.33	.23	.19	.19	.16	.09	.18	.23
p-value	.001	.000	.000	.000	.000	.000	.294	.003	.000	.000

Table 12: All problems: *Within* and *within+* designs

Appenc



	ELLS	CC ALLAIS	AUCT	ELECT	CR ALLAIS
% fail SEP/DOM	50.5	28.7	17.8	69.3	28.7
% fail C-SEP/C-DOM	38.6	35.7	20.8	47.5	24.7
(▲) p-value	0.092	0.280	0.518	0.001	0.498
% fail STP	69.3	60.4	20.8	41.6	32.7
$q_{C\|I}$	0.61	0.59	0.50	0.46	0.66
$q_{I\|C}$	0.38	0.33	0.14	0.32	0.21
(⊗) p-value	0.022	0.022	0.006	0.200	0.000

Figure 19: *WithinCNC* design: summary of results

Appendices : Descriptions of Each Problems

CC ALLAIS

- There is an
  89 are B. I
  million for
  and $100 n
  f’, which g
  gives $500
  significant
  (risky opti

		A		A^c
		R (1)	Y (10)	B (89)
Question 1	f	$100m	$100m	$100m
	g	$0	$500m	$100m
Question 2	f'	$100m	$100m	$0
	g'	$0	$500m	$0

Figure 2: CC ALLAIS

are Y, and
gives $100
ll is yellow
ose between
nd g’ , which
at a
1 and g’

Appendices : Descriptions of Each Problems

AUCT

- Consider a
  the second
  other bidd
  bid amour
  integer bic
  an outside

		A	A^c	
		\$4.50	\$0.50	\$8.50
Quest.*	f	\$3	\$3	\$3
	g	\$1	\$1	\$1
Quest. 1	f'	\$3	\$5	\$3
	g'	\$1	\$5	\$3

(a) AUCT

id pays the bid of
subject and one
equally likely to
choose an
the auction and

Appendices : Descriptions of Each Problems

Common Value

- There is an urn
randomly draw
(w), both comp
computers vote
color of the dra
choose betwee
chosen by the
gets $5; otherw

		A	A^c
		bWB	**wWW**
Quest.*	f	\$5	\$5
	g	\$0	\$0
Quest. 1	f'	\$5	\$5
	g'	\$0	\$5

(b) ELECT

s, and one ball is
drawn ball is white
vn ball is black (b),
observing either the
ers, the subject must
hite. If the color
awn ball, the subject

Appendices : Descriptions of Each Problems

Common-Rati

- There is a jar
  Question 1 (
  yellow, and 8
  $4 if the draw
  it is red. In C
  subject must
  option that g
- x is a lottery
  $5.30 with p
  pays $0 for s

		RY	B
Quest.2	f	x	x
	g	y	y
Quest. 1	f'	x	\$0
	g'	y	\$0

(c) CR ALLAIS

vo questions,
s 12 red, 3
ption that gives
gives $5.30 if
alls. The
r sure and an

y that gives
is a lottery that

Appendices : Descriptions of Each Problems

		A		A^c
		R (1)	Y (10)	B (89)
Question 1	f	\$100m	\$100m	\$100m
	g	\$0	\$500m	\$100m
Question 2	f'	\$100m	\$100m	\$0
	g'	\$0	\$500m	\$0

Figure 2: CC ALLAIS

		A	A^c	
		\$4.50	\$0.50	\$8.50
Quest.*	f	\$3	\$3	\$3
	g	\$1	\$1	\$1
Quest. 1	f'	\$3	\$5	\$3
	g'	\$1	\$5	\$3

(a) AUCT

		RY	B
Quest.2	f	x	x
	g	y	y
Quest. 1	f'	x	\$0
	g'	y	\$0

(c) CR ALLAIS

		A	A^c
		bWB	**wWW**
Quest.*	f	\$5	\$5
	g	\$0	\$0
Quest. 1	f'	\$5	\$5
	g'	\$0	\$5

(b) ELECT