Online Appendix B: Additional Control Treatments

Recent work by Holt and Smith (2016) compares direct-elicitation and list-based formats of the SBDM using a larger set of Bayesian tasks. Consistent with our results, they do not find significant differences in accuracy between formats when all data is used. However, there is some evidence that the list-based format performs better in a subset of simple decision problems where the true probability of the paid event is .5. This suggests that there may be an interaction between the difficulty of the Bayesian task and the accuracy of reports.

As an additional robustness check, we ran a follow-up experiment with a simplified task that does not require Bayesian updating. In the task, subjects are shown a wheel with six equidistant sections numbered 1 to 6. Subjects are told that we will spin the wheel in each period and that each of the sections is equally likely to be selected. In each period, a subject is assigned a set of either two or four numbers. They are paid $15 if the spinner lands on one of their numbers and $0 otherwise. As in our original experiment, the true probability of the assigned event is either .33 or .66 and the mechanism is designed to induce a report of this probability.

Our follow up "Spinner Task" experiments consisted of 102 subjects who participated in six experiments over three days. Subjects were randomized into formats within each session. In total we had 34 subjects in the HS format, 35 subjects in the HH format, and 33 subjects in the TK format. All other features of our protocol were identical to the original treatment.

Table 8 shows the accuracy rates from our Original Task, the Spinner Task, and the Task used in Holt and Smith (2016). As can be seen in the second row, accuracy in spinner task ranges between 10.5 and 15.0 between treatments. Similar to the Original Task, there is no significant difference in accuracy in the Kruskal–Wallis test and no difference in any of the pairwise comparisons using Dunn's test for stochastic dominance. Boundary reports were also similar to our Original Task and were observed in 1.6% of cases in the HS treatment, in 5.1% of cases in the HH treatment, and in 8.5% of cases in the TK treatment.

Online Appendix C: Instructions and Quizzes

The Bucket Game

Thank you for choosing to participate in today's experiment. This experiment is an opportunity to earn money. You will be paid in cash at the end of the experiment. You will be paid a $15 attendance fee plus earnings from a computerised experiment. If you have any questions during the experiment please sit quietly and raise your hand. An

	Treatment Means			KW-test	Pairwise Dunn Tests		
	HS	*HH*	*TK*		*HS*v*HH*	*HS*v*TK*	*HH*v*TK*
Original Task (N = 125, T = 15)	12.4 (1.53)	13.1 (1.43)	14.7 (1.61)	0.546	0.326	0.410	0.393
Spinner Task (N = 102, T = 15)	10.5 (1.85)	12.5 (1.58)	15.0 (2.44)	0.365	0.299	0.265	0.376
Holt and Smith (2016) (N = 72, T = 12)	9.9 (0.67)	N/A	7.0 (0.53)	N/A	N/A	0.109	N/A

Table 8: Mean Abs. Errors for the HS, HH and TK Treatments using the original task, the spinner task, and the task in Holt and Smith (2016). The Kruskall-Wallis test is performed at the measure level and the Dunn pairwise tests adjusted for multiple hypotheses using the Benjamin-Hochbern adjustment. Standard errors are reported in parentheses.

experiment assistant will be with you as soon as possible.

Payment for the computerised experiment: You will play a computerised game 15 times. Each repetition of the game is called a "period." In each period you will win a prize of $15 or $0. At the end of the experiment, 1 of the 15 periods will be chosen randomly by the computer. Each period is equally likely to be chosen. Your cash payment for the computerised experiment will be your prize from the randomly chosen period. Although you will play 15 periods, you are only paid in cash for the prize you earn in a single period.

The Bucket Game: You are going to participate in a game which is referred to as "The Bucket Game." There are two buckets: Bucket A and Bucket B. Bucket A contains 2 light balls and 1 dark ball. Bucket B contains 1 light ball and 2 dark balls. (These buckets and balls are all computerised.)

One of the buckets will be randomly chosen by the computer. Both buckets have an equal chance of being chosen. (You might imagine that the computer tosses a coin to decide which bucket will be used.) You will not be told which bucket has been chosen by the computer. The computer will randomly select a ball from the chosen bucket. Each ball has an equal chance of being chosen. You will be told the color of the ball.

Holt and Smith Treatment Instructions

(Subject receives standard Bucket Game instructions.)

Bucket Game: reporting your beliefs

After seeing a random ball from one of the buckets, you will report your belief about the chance that Bucket A is being used. You will indicate a number between 0 and 100, which we will call P. This means that you think that the chance that Bucket A is being used is "P out of 100."

For example: If you could be sure that Bucket A is being used, you should choose P

= 100, which would indicate that you believe the chances are 100 out of 100 that Bucket A is being used. If you could be sure that Bucket A is not being used, you should choose P = 0 to indicate that the chances are 0 out of 100 that Bucket A is being used. Thus the magnitude of P corresponds to the chance that Bucket A is being used. For example, if you think that it is just as likely that Bucket A is being used as Bucket B, then you should choose P = 50, indicating that the chances are 50 out of 100 that Bucket A is being used.

If you indicate that the chances are P out of 100 that Bucket A is being used, then you should be indifferent between:

- Lottery A: being paid a prize ($15) if Bucket A is in fact being used, and $0 otherwise...; and

- A "P" lottery: being paid a prize ($15) in a lottery with P chance of getting $15, and $0 otherwise.

Notice that in each of these two options, the chances of earning the $15 prize are P out of 100, and this is the sense in which they are equivalent. Let me summarize. If you indicate that the chances of Bucket A being used are P out of 100, then you should be indifferent between:

1. getting $15 if Bucket A is being used; and

2. getting $15 with chance P out of 100.

The following procedure will be used to help you choose the value of P that makes you indifferent between the A lottery in (1) and the P lottery in (2) above.

After you record the value of P (between 0 and 100) that represents your beliefs about the chances of Bucket A being used, the computer will randomly select a number "N" between 0 and 100. Each number is equally likely to be chosen. Because it's like rolling a dice to randomly choose a number, this is called the "Dice Lottery." The "Dice Lottery" pays a cash prize ($15) with chance N out of 100, and $0 otherwise.

Recall that you will have told us a number P that represents the chance that the Lottery will pay 1 $15 prize, i.e. the chance that Bucket A is being used. In determining your payoffs for the period, we will use whichever is better for you, the Dice Lottery or the A Lottery. We will make the decision on which lottery is better for you by comparing the randomly determined N and the P that you tell us represents your beliefs about the chances that Bucket A is beling used.

Case of N less than P: If the "dice throw" results in N less than P, then the Dice Lottery offers a lower chance of the cash prize than the A lottery and Lottery P. We will reject the Dice Lottery and your earnings for the period will be determined by the A lottery: $15 if Bucket A is being used, $0 otherwise.

Case of N greater than P: If N is greater than or equal to P, then the Dice Lottery offers an equal or higher chance of the cash prize than the A Lottery and the P Lottery. We will accept the Dice Lottery and it will determine your earnings for the period: $15 with N in 100 chance.

Think of it this way: you can either take the A lottery, which is equivalent to a chance of P out of 100 of earning $15, or you can take the Dice Lottery. We will make the decision of whether to accept or reject this Dice Lottery by comparing N with the value of P that you nominated. If you tell us the value of P that best represents your beliefs about the chance (out of 100) that Bucket A is being used, then we can make the best decision for you about whether to accept or reject the Dice Lottery.

To summarize: You will be told a bucket has been randomly chosen. Then you will be told the color of the ball that has been randomly chosen from that bucket, and you write the number P between 0 and 100 that represents your beliefs about the chances out of 100 that Bucket A is being used.

There are two alternative ways that you can earn the $15 prize instead of the $0 prize. Your earnings will either be determined by the A Lottery ($15 if A is being used) or by the Dice Lottery ($15 if the computer randomly selects a number less than N).

You should think carefully about the value P that represents your beliefs about getting the $15 prize under the A Lottery, since we will use P to decide whether or not to replace the A Lottery with the Dice Lottery for determining your earnings.

You will play this game a total of 15 times. In each period you will earn a period prize of $15 or $0. At the end of the experiment 1 of the 15 periods will be randomly chosen to determine your cash payment from the experiment.

Holt and Smith Treatment Quiz

Imagine that you are shown a ball. Based on its color you report your belief that there is a 20-in-100 chance that the ball is from Bucket A. The computer randomly selects N = 25 for the Dice Lottery.

1. Which game will be used to determine your prize for the Period? (Subject chooses between the A Lottery and Dice Lottery?)

2. What is your chance in 100 of winning $15? (Subject enters integer.)

3. What is your chance in 100 of winning $0? (Subject enters integer.)

Imagine you start a new period. You are shown a new ball. This time you believe there is an 81-in-100 chance the ball was taken from Bucket A... but you make an error! You type "18" by mistake. The computer thinks you believe there is an 18-in-100 chance of winning $15 in the A Lottery.

The computer randomly selects N = 25 for the Dice Lottery.

4. What do *you* believe is your chance in 100 of winning $15 if you play the A Lottery? (Subject enters integer.)

5. What is your chance in 100 of winning $15 if you play the Dice Lottery? (Subject enters integer.)

6. Which game will be used to determine your prize for the period? (Subject chooses between the A Lottery and Dice Lottery?)

Thank you. You have completed the Quiz. The experiment is about to begin.

Hao and Houser Treatment: Instructions

(Subject receives standard Bucket Game instructions.)

After seeing the color of the ball, you need to think about the chance that the ball was drawn from Bucket A. This is your "belief" that the ball was drawn from Bucket A. You will then report a number between 0 and 100 to indicate the chance-in-100 that the ball has been drawn from Bucket A.

For example: If you are sure that Bucket A is being used, your belief is that there is a 100 in 100 chance that Bucket A is being used. If you are sure that Bucket A is not being used, your belief is that there is a 0 in 100 chance that Bucket A is being used. If you believe that it is equally likely that Bucket A is being used as Bucket B, then your belief is that there is a 50 in 100 chance that Bucket A is being used.

We will use your reported belief to help determine your prize in each period. This is how we determine your prize:

The computer creates a *Lottery Bag*: The computer randomly chooses a number between 0 and 100. Each number is equally likely to be chosen. Although the computer knows this number, you do not. We call this randomly chosen number *"?"*. The computer fills a bag with 100 chips. *"?"* chips are black and the rest are white. *"?" in 100 chips are black.* There are now two ways to win a prize of $15: the Bucket Game and the Lottery Bag Game.

THE BUCKET GAME:	**THE LOTTERY BAG GAME:**
Prize of $15 if the ball was from Bucket A. Prize of $15 if the ball was from Bucket B.	Prize of $15 if you draw a black chip. Prize of $15 if you draw a white chip.
Chance-in-100 of winning $15: Belief that ball is from Bucket A	**Chance-in-100 of winning $15:** "?"-in-100

The computer knows the chance of winning $15 in the Lottery Bag Game. Based on your reported belief that the ball was drawn from Bucket A, the computer will select the game that gives you the highest chance of winning $15. (If the games give you an equal chance of winning you will play the Lottery Bag Game.)

You should think carefully about your belief that the ball has been drawn from Bucket A, as we will use your reported belief to decide whether you are paid according to the Bucket Game or the Lottery Bag Game.

Summary: You will be told the color of a ball. You will report your belief that the ball was drawn from Bucket A. There are two ways to win $15:

- The Bucket Game awards $15 if the ball was drawn from Bucket A, and $15 if it was drawn from Bucket B.
- The Lottery Bag Game award $15 if a black chip is drawn from the bag, and $0 if a white chip is drawn. There is an unknown, random chance of winning $15.

Based on your reported belief that the ball has been drawn from Bucket A you will play whichever game gives you a higher chance of winning $15. You should think carefully about your belief that the ball has been drawn from Bucket A.

You will play this game a total of 15 times. In each period you will earn a period prize of $15 or $0. At the end of the experiment 1 of the 15 periods will be randomly chosen to determine your cash payment from the experiment.

Hao and Houser Treatment: Quiz

This is identical to the Holt and Smith Quiz, but with references to the Lottery Bag Game rather than the Dice Lottery, and with references to the Bucket Game rather than the A Lottery.

Trautmann and van de Kuilen Treatment: Instructions

(Subject receives standard Bucket Game instructions.)

Before you learn which bucket was used you will choose how your prize is determined in this period. You need to think about whether the ball has been taken from Bucket A or Bucket B. We ask you to think about the chance-in-100 that the ball has been taken from Bucket A. This is your "belief" that the ball is from Bucket A." Your belief is important, because you will use it to make a decision in a Payment Game.

The Payment Game

You will see a list of choices. One is labelled "Bucket Game" and the other "Lottery Game." In each choice the Bucket Game yields:

- $15 prize if the ball was pulled from Bucket A

- $0 prize if the ball was pulled form Bucket B

In each choice the Lottery Game yields $15 with a particular probability, and $0 otherwise.

In the first choice, the Lottery Game gives you a 0-in-100 chance of winning $15. We imagine that most people would prefer the Bucket Game in Choice 1, because the Bucket Game has a chance of winning $15, whereas the Lottery Game has no chance of winning $15. In the last choice the Lottery Game gives you a 100-in-100 chance of winning $15. We imagine that most people would prefer the Lottery Game in the final choice, since the Lottery Game wins $15 for sure, while the Bucket Game only has a chance of winning $15. We therefore imagine that most people will switch from choosing the Bucket Game to the Lottery Game at some point in the list.

Bucket Game		**Lottery Game**		**Example Decision**
If ball drawn from Bucket A	If ball drawn from Bucket B	Chance in 100 of winning $15	Chance in 100 of winning $0	Prefer Bucket Game or Lottery Game?
$15	$0	0	100	Bucket Game
$15	$0	1	99	Bucket Game
$15	$0	2	98	Bucket Game
...etc	...etc	...etc	...etc	...
$15	$0	98	2	Lottery Game
$15	$0	99	1	Lottery Game
$15	$0	100	0	Lottery Game

There are 101 Lottery Game choices. We need to know whether you prefer the Bucket Game or Lottery Game for each choice. We try to make this easier by using a two-stage process. In Stage 1 we ask you to indicate *roughly* the point where you switch to preferring the Lottery Game. In Stage 2 we ask you to indicate *exactly* when you prefer the Lottery Game to the Bucket Game.

For example, imagine that you believe the Bucket Game has a 23-in-100 chance of winning a $15 prize. We imagine that you would prefer the Lottery Game if it has a 24-in-100 chance of paying $15.

In Stage 1 you would indicate that you want to switch from the Bucket Game to the Lottery Game when the Lottery Game has a probability of winning that lies between 20 and 29 in 100.

Bucket Game		**Lottery Game**		**Switch?**
If ball drawn from Bucket A	If ball drawn from Bucket B	Chance in 100 of winning $15	Chance in 100 of winning $0	Switch from Bucket Game to Lottery Game?
$15	$0	0-9	91-100	
$15	$0	10-19	81-90	
$15	$0	20-29	71-80	(Example) **Switch**

In Stage 2 you would refine your choice and indicate that you switch to preferring the Lottery Game when it has a 24-in-100 chance of winning $15.

Although we imagine that most people would switch from the Bucket Game to the Lottery Game at some point in the list, it is entirely up to you what to do in each of the

Bucket Game		Lottery Game		Example Decision
If ball drawn from Bucket A	If ball drawn from Bucket B	Chance in 100 of winning $15	Chance in 100 of winning $0	Prefer Bucket Game or Lottery Game?
$15	$0	20	80	Bucket Game
$15	$0	21	79	Bucket Game
$15	$0	22	78	Bucket Game
$15	$0	23	77	Bucket Game
$15	$0	24	76	Lottery Game
$15	$0	25	75	Lottery Game
...etc	...etc	...etc	...etc	...etc

choices. After you have made your choices the computer will randomly select one of the Lottery Games. The computer will check whether you preferred to play that particular Lottery Game or the Bucket Game. If you preferred the Bucket Game, you will get $15 if the ball was drawn from Bucket A, and $0 otherwise. If you preferred the Lottery Game, the computer will conduct the Lottery. You will get $15 if you win, and $0 otherwise. Remember that you will play 15 Periods, and that 1 Period will be randomly chosen to be pain in cash at the end of the experiment.

Summary: You will be told the color of a ball. It has been drawn from Bucket A or B. Your prize will be determined by the Bucket Game or the Lottery Game. There are 101 versions of the Lottery Game. Across 2 stages you will indicate when you switch from preferring the Bucket Game to the Lottery Game.

The computer randomly chooses one of the Lottery Games. If you preferred the Bucket Game, your prize will be $15 if the ball was from Bucket A, and $0 if it was from Bucket B. If you preferred the Lottery Game, your prize is $15 if you win with a particular probability, or $0 otherwise.

You will play this game a total of 15 times. Each time you will win $15 or $0. At the end of the experiment one period will be randomly chosen. Your winnings from that period will be paid in cash. This means that each one of your choices could eventually determine your payment.

Trautmann and van de Kuilen Treatment: Quiz

Imagine you believe that there is a 20-in-100 chance the ball was drawn from Bucket A.

1. Based on your belief, does a Lottery with a 21-in-100 chance of $15 give you a higher or lower chance of winning $15? (Subject chooses between "Higher" and "Lower.")

2. Based on your belief, does a Lottery with a 19-in-100 chance of $15 give you a higher or lower chance of winning $15? (Subject hooses between "Higher" and "Lower.")

3. If you wanted to switch from the Bucket Game to the Lottery Game to maximise your chance of winning $15, what would you choose in Stage 1? (Subject nominates switch point in table below.)

Bucket Game		Lottery Game		Switch?
If ball drawn from Bucket A	If ball drawn from Bucket B	Chance in 100 of winning $15	Chance in 100 of winning $0	Switch from Bucket Game to Lottery Game?
$15	$0	0-9	91-100	(Subject indicates)
$15	$0	10-19	81-90	(Subject indicates)
$15	$0	20-29	71-80	(Subject indicates)

4. And what would you choose in Stage 2? (Subject indicates Bucket or Lottery Game preferences in table below.)

Bucket Game		Lottery Game		Example Decision
If ball drawn from Bucket A	If ball drawn from Bucket B	Chance in 100 of winning $15	Chance in 100 of winning $0	Prefer Bucket Game or Lottery Game?
$15	$0	20	80	(Subject indicates)
$15	$0	21	79	(Subject indicates)
$15	$0	22	78	(Subject indicates)
$15	$0	23	77	(Subject indicates)
...etc	...etc	...etc	...etc	...etc

Thank you. You have completed the Quiz. The experiment is about to begin.