Supplement to "**Stochasticity and Uncertainty**

Experimentally Investigating Preference (In)Consistency in Two-Stage Decision Problems"

A: lotteries

A1: **the lotteries used in the experiment**

We assume throughout that our subjects have CRRA-SMRA[1] preferences with relative risk aversion *r.* We took a set of *x* values:

[10,11,12,12,12,14,14,14,16,16,16,18,18,18,20,20,20,22,22,22,24,24,24,55,59,64,66],

associated with them a corresponding set of *y* values:

y=[6,7,8,6,7,8,6,7,8,6,7,8,6,7,8,6,7,8,6,7,8,6,7,8,6,7,8], and then for i=*1,2,…,26* assumed that the level of risk aversion *r* that made the DM indifferent between lottery number *i* and lottery number *i+1* (which we denote by $r^*_{i,i+1}$) were such that $r^*_{i,i+1} = 1.5 - 0.1(i-1)$. We then found the value of the p_i (*i=2,…27)* to guarantee the indifference. The resulting lotteries are in table 1.

Table 1: 27 lotteries used in the experiment

lottery	x	p	y
1	10	1	6
2	11	0.802	7
3	12	0.568	8
4	12	0.753	6
5	12	0.681	7
6	14	0.417	8

[1] CRRA is Constant Relative Risk Aversion. SMRA is Stochastically More Risk Averse (see Wilcox 2011)

7	14	0.610	6
8	14	0.530	7
9	16	0.339	8
10	16	0.509	6
11	16	0.436	7
12	18	0.290	8
13	18	0.430	6
14	18	0.369	7
15	20	0.253	8
16	20	0.365	6
17	20	0.317	7
18	22	0.224	8
19	22	0.310	6
20	22	0.273	7
21	24	0.199	8
22	24	0.262	6
23	24	0.235	7
24	55	0.045	8
25	59	0.051	6
26	64	0.040	7
27	66	0.034	8

A2: **The r*s**

These $r^*_{i,i+1}$ imply important properties. For example, if a subject's risk aversion *r* is equal to $r^*_{i,i+1}$ then she is indifferent between lottery *i* and lottery *i+1;* moreover if *r>* *(<)* $r^*_{i,i+1}$ then she prefers lottery *i* to lottery *i+1* (prefers lottery *i+1* to lottery *i).* The complete set of $r^*_{i,i+1}$ are shown in table 2 which are heightened in red.

While the resulting lotteries have useful properties, there is one that they do not have. Examine table 2. It will be seen that the entries in the rows are not monotonic. This implies that preference over lotteries is not monotonic. However, it is true that lottery 1 is certain and thus is preferred by all very risk-averse subjects, and that *in general* the riskiness increases with the lotter number. Importantly, however, we can associate preference for a particular lottery with risk aversion. Examine the figure 1 below, which shows for each level of risk aversion, the most preferred lottery.

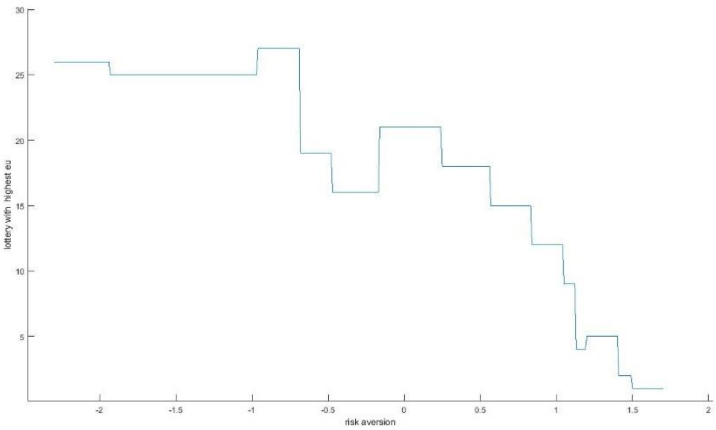
Table 2: the indifference points between each pair of lotteries

*	1.500	1.483	1.381	1.457	1.402	1.180	1.295	1.343	0.997	1.151	1.282	0.820	1.012	1.210	0.650	0.874	1.125	0.485	0.736	1.026	0.327	0.597	0.051	-0.314	-0.222	-0.017
1.500	*	1.400	1.312	1.410	1.322	1.103	1.215	1.269	0.916	1.066	1.207	0.738	0.923	1.132	0.567	0.783	1.041	0.402	0.643	0.935	0.244	0.502	-0.044	-0.365	-0.285	-0.103
1.483	1.400	*	1.300	1.413	1.306	1.086	1.198	1.255	0.897	1.046	1.192	0.717	0.902	1.115	0.544	0.759	1.022	0.378	0.618	0.913	0.219	0.476	-0.073	-0.382	-0.305	-0.130
1.381	1.312	1.300	*	1.200	1.287	0.955	1.033	1.121	0.772	0.897	1.075	0.595	0.758	0.992	0.425	0.619	0.890	0.262	0.479	0.771	0.105	0.340	-0.186	-0.443	-0.379	-0.230
1.457	1.410	1.413	1.200	*	1.100	1.013	1.108	1.167	0.831	0.967	1.119	0.653	0.826	1.044	0.482	0.686	0.949	0.317	0.545	0.837	0.159	0.405	-0.133	-0.415	-0.345	-0.184
1.402	1.322	1.306	1.287	1.100	*	1.000	1.111	1.196	0.805	0.946	1.124	0.621	0.796	1.035	0.445	0.650	0.930	0.276	0.504	0.808	0.114	0.359	-0.185	-0.446	-0.382	-0.230
1.180	1.103	1.086	0.955	1.013	1.000	*	0.900	0.888	0.574	1.652	0.589	0.396	0.499	28.002	0.225	0.377	1.741	0.062	0.244	0.555	-0.094	0.107	-0.367	-0.547	-0.502	-0.388
1.295	1.215	1.198	1.033	1.108	1.111	0.900	*	0.800	0.696	0.810	1.159	0.511	0.665	0.963	0.336	0.520	0.826	0.168	0.376	0.686	0.008	0.233	-0.284	-0.501	-0.447	-0.316
1.343	1.269	1.255	1.121	1.167	1.196	0.888	0.800	*	0.700	0.809	1.043	0.516	0.670	0.942	0.338	0.526	0.824	0.167	0.380	0.690	0.004	0.233	-0.293	-0.509	-0.455	-0.325
0.997	0.916	0.897	0.772	0.831	0.805	0.574	0.696	0.700	*	0.600	0.575	0.208	0.862	0.401	0.038	2.225	NaN	-0.125	0.003	0.781	-0.280	-0.119	3.016	-0.632	-0.599	3.105
1.151	1.066	1.046	0.897	0.967	0.946	1.652	0.810	0.809	0.600	*	0.500	0.386	0.509	NaN	0.200	0.361	1.831	0.027	0.214	0.576	-0.136	0.068	-0.411	-0.575	-0.533	-0.426
1.282	1.207	1.192	1.075	1.119	1.124	0.589	1.159	1.043	0.575	0.500	*	0.400	0.506	0.833	0.223	0.382	0.703	0.052	0.242	0.558	-0.113	0.097	-0.396	-0.569	-0.526	-0.414
0.820	0.738	0.717	0.595	0.653	0.621	0.396	0.511	0.516	0.208	0.386	0.400	*	0.300	0.271	-0.140	0.469	0.122	-0.302	1.491	NaN	-0.456	2.335	2.375	-0.697	-0.672	2.474
1.012	0.923	0.902	0.758	0.826	0.796	0.499	0.665	0.670	0.862	0.509	0.506	0.300	*	0.200	0.080	0.205	NaN	-0.105	0.056	NaN	-0.274	-0.092	-0.517	-0.639	-0.606	-0.516
1.210	1.132	1.115	0.992	1.044	1.035	28.002	0.963	0.942	0.401	32.220	0.833	0.271	0.200	*	0.100	0.203	0.565	-0.071	0.086	0.410	-0.237	-0.051	-0.493	-0.626	-0.591	-0.495
0.650	0.567	0.544	0.425	0.482	0.445	0.225	0.336	0.338	0.038	0.200	0.223	-0.140	0.080	0.100	*	0.000	-0.030	-0.470	0.147	-0.164	-0.623	1.009	1.866	-0.742	-0.722	1.979
0.874	0.783	0.759	0.619	0.686	0.650	0.377	0.520	0.526	2.225	0.361	0.382	0.469	0.205	0.203	0.000	*	-0.100	-0.223	-0.099	25.543	-0.405	-0.250	-0.603	-0.690	-0.664	-0.586
1.125	1.041	1.022	0.890	0.949	0.930	1.741	0.826	0.824	32.220	1.831	0.703	0.122	32.220	0.565	-0.030	-0.100	*	-0.200	-0.100	0.250	-0.367	-0.215	-0.579	-0.676	-0.648	-0.566
0.485	0.402	0.378	0.262	0.317	0.276	0.062	0.168	0.167	-0.125	0.027	0.052	-0.302	-0.105	-0.071	-0.470	-0.223	-0.200	*	-0.300	-0.331	-0.782	-0.151	1.423	-0.765	3.250	1.554
0.736	0.643	0.618	0.479	0.545	0.504	0.244	0.376	0.380	0.003	0.214	0.242	1.491	0.056	0.086	0.147	-0.099	-0.100	-0.300	*	-0.400	-0.523	-0.405	2.914	-0.727	-0.705	3.065
1.026	0.935	0.913	0.771	0.837	0.808	0.555	0.686	0.690	0.781	0.576	0.558	32.220	32.220	0.410	-0.164	25.543	0.250	-0.331	-0.400	*	-0.500	-0.403	-0.650	-0.717	-0.694	-0.622
0.327	0.244	0.219	0.105	0.159	0.114	-0.094	0.008	0.004	-0.280	-0.136	-0.113	-0.456	-0.274	-0.237	-0.623	-0.405	-0.367	-0.782	-0.523	-0.500	*	-0.600	1.005	-0.763	2.674	1.162
0.597	0.502	0.476	0.340	0.405	0.359	0.107	0.233	0.233	-0.119	0.068	0.097	2.335	-0.092	-0.051	1.009	-0.250	-0.215	-0.151	-0.405	-0.403	-0.600	*	-0.700	-0.748	-0.728	2.571
0.051	-0.044	-0.073	-0.186	-0.133	-0.185	-0.367	-0.284	-0.293	3.016	-0.411	-0.396	2.375	-0.517	-0.493	1.866	-0.603	-0.579	1.423	2.914	-0.650	1.005	2.403	*	-0.800	-0.769	-0.508
-0.314	-0.365	-0.382	-0.443	-0.415	-0.446	-0.547	-0.501	-0.509	-0.632	-0.575	-0.569	-0.697	-0.639	-0.626	-0.742	-0.690	-0.676	-0.765	-0.727	-0.717	-0.763	-0.748	-0.800	*	-0.900	-0.963
-0.222	-0.285	-0.305	-0.379	-0.345	-0.382	-0.502	-0.447	-0.455	-0.599	-0.533	-0.526	-0.672	-0.606	-0.591	-0.722	-0.664	-0.648	3.250	-0.705	-0.694	2.674	-0.728	-0.769	-0.900	*	-1.000
-0.017	-0.103	-0.130	-0.230	-0.184	-0.230	-0.388	-0.316	-0.325	3.105	-0.426	-0.414	2.474	-0.516	-0.495	1.979	-0.586	-0.566	1.554	3.065	-0.622	1.162	2.571	-0.508	-0.963	-1.000	*

'NaN' indicates that one problem dominates the other

* Has no meaning.

Figure 1: the most preferred problem as a function of risk-aversion



B： Experimental Instructions and Software

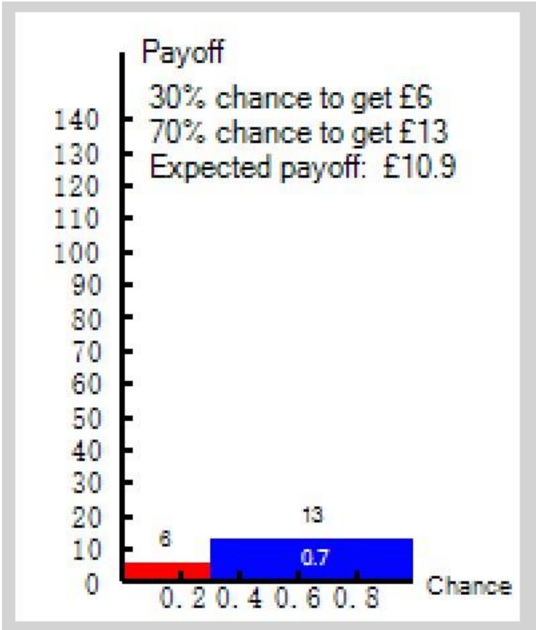
B1: instructions

Welcome to this experiment. Thank you for participating. It is an online experiment and hence different from an experiment in the lab. The differences are explained in a separate document. This document is solely about what you are being asked to do in the experiment.

Please read this document carefully. If you have any questions, please use the Chat on Zoom to send a message to the host or co-host, and your question will be answered privately. Please switch off our mobile phone, and concentrate on the experiment; your payment depends upon your answers.

Lotteries

This experiment is all about *lotteries*. Lotteries have random outcomes. All lotteries in this experiment have the same format. A typical lottery is shown below.



The vertical dimension shows the possible payoffs, denominated in £s. The horizontal dimension shows the probabilities of the possible payoffs. So, the lottery shown in the figure above has a 70% chance of resulting in a payment of £6 and a 30% chance of resulting in a payment of £13. Note that in this example, there are just two possible outcomes, a low one and a high one. This will be the same in all lotteries: there will be a low outcome (in this example £6) and a high outcome (in this example, £13); these will vary from lottery to lottery as will the chances of the two outcomes. The red part of the figure relates to the low outcome, the blue part to the high. The figure also shows the *Expected Payoff* of the lottery – that is the payoff you can expect on average if the lottery is played out many times: 30% of the time the payoff would be £6 and 70% of the time it would be £13, so on average the payoff would be 0.3*6+0.7*13= 10.9*. Your valuation will be less than this expected payoff if you dislike risk, and it will be more if you like risk.*

Playing out a lottery

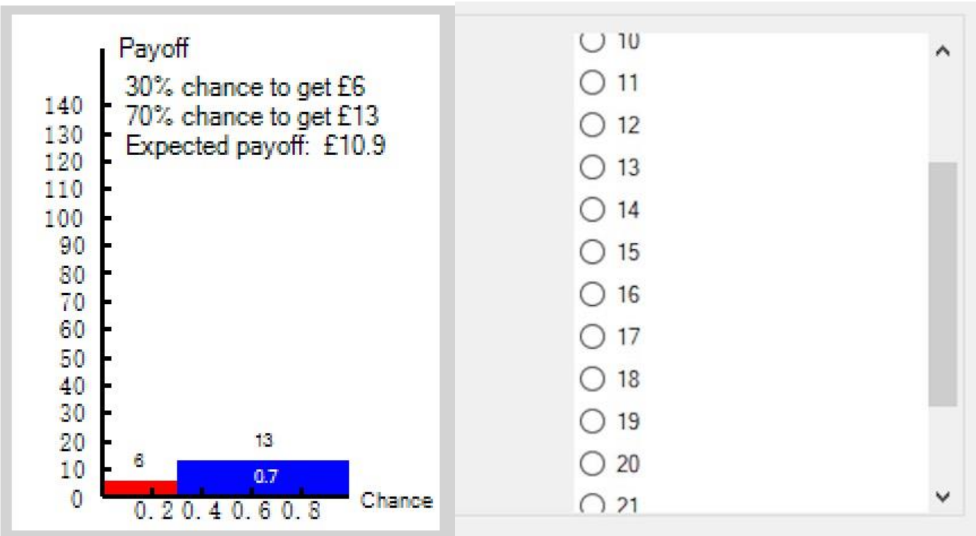
When we come to determine your payment, we may need to play out a lottery. This will be done as follows. We use the lottery above as an example. This lottery has a

70% chance that the outcome will be £6 and a 30% chance that the outcome will be £13. To determine the outcome, the computer will generate a random number between 0 and 1. If this number is less than 0.7 (that is, between 0 and 0.70), the outcome will be £6; if this number is equal to, or greater than 0.7 (that is, between 0.70 and 1) the outcome will be £13. This guarantees that there is a 70% chance that the outcome is £6 and a 30 chance that it will be £13.

The experiment

It has two parts: Part 1 and Part 2. Part 1 consists of 27 problems, and Part 2 consists of 30 problems. They are described below. At the end of the experiment, one of the total of 57 problems will be chosen at random, and your decision on that problem will be 'played out'. How this will be done is described in 'The Payment Procedure' below.

PART 1



In this part, each problem has the same purpose: we want to elicit **your valuation** of a lottery, that is, how much **you** value the lottery. As this is an important concept, we should explain it carefully.

To determine your valuation, you should imagine that you are given a choice between accepting (and playing out) the lottery or accepting a number of pounds. If the number of £s was equal to the low outcome, you would presumably prefer to accept (and play out) the lottery (as you are guaranteed to get at least the low outcome from the lottery). If the number of £s was equal to the high outcome, you would presumably prefer to accept the £s (since you are not going to gain more than that from the lottery). As the number of £s increases from the low outcome towards the high outcome, you would find that the £s were becoming increasingly attractive to you; and, at some point, you would switch from preferring the lottery to preferring the £s. That switch point is your valuation. In other words, your valuation of the lottery is the number of £s for which you find the money and the lottery equally attractive, and you would have difficulty in saying which you preferred. Note crucially that **your** valuation (which is what we want you to tell us) is entirely personal: it depends on **you** and on **your** attitude to risk.

We will elicit your valuation as follows. We will show a particular lottery on the left of the screen and a drop-down list of numbers on the right. We want you to indicate your valuation of the lottery on the left by ticking one of the numbers on the right. To provide you with an incentive to reveal your true evaluation, we will use the following method to pay you if one of these problems is played out at the end of the experiment:

> *We will randomly select one of the numbers from the drop-down list. If that number is less than the number that you have ticked, we will play out the lottery on the left; if that number is equal to or greater than the number that you have ticked, your payment will be the number that you have ticked.*

Note that it is in your interest to tick the right number. Suppose, for the example above, your valuation of the lottery is 15. If you tick a number lower than your valuation, say 12, then when the random number generated by the computer is greater than 12, your payment would be 12, whereas in fact you would prefer to play out the lottery (since you value the lottery at more than 12). If you tick a number greater than your valuation, say 19, then when the random number generated by the computer is less than 19, you would have to play out the lottery, whereas in fact you would prefer the sum of money since you value the lottery less than 19).

PART 2

Each problem in this Part has two stages. In the first stage, you will be presented with a set of *menus*, each menu consisting of a set of lotteries, and you will be asked to choose *one* menu. In the second stage, you will be asked to choose *one* lottery out of your chosen menu. If one of the problems in Part 2 is chosen for payment, we will simply play out your chosen lottery.

The Payment Procedure

When you have completed the experiment, the software will take you to the payment stage. This will proceed as follows. First, the computer will select at random one of the two Parts; it will tell you which Part it has selected, and then the computer will select at random one of the problems in that Part. Depending upon which Part it has selected, the procedure will be different.

If it is a problem from Part 1, the computer will recall your answer. Then, as we described above, the computer will randomly select one of the numbers from the drop-down list. If that number is less than the number that you ticked, we will play out the lottery on the left; if that number is equal to or greater than the number that you ticked, your payment in £ will be the number that you ticked.

If it is a problem from Part 2, the computer will recall your choice. This will be a lottery. We will then play out the lottery.

The show-up fee of £2.50 will be added to the payment as described above. You will be paid with an Amazon Voucher.

If you have any questions, please ask one of the experimenters.

Thank you for your participation.

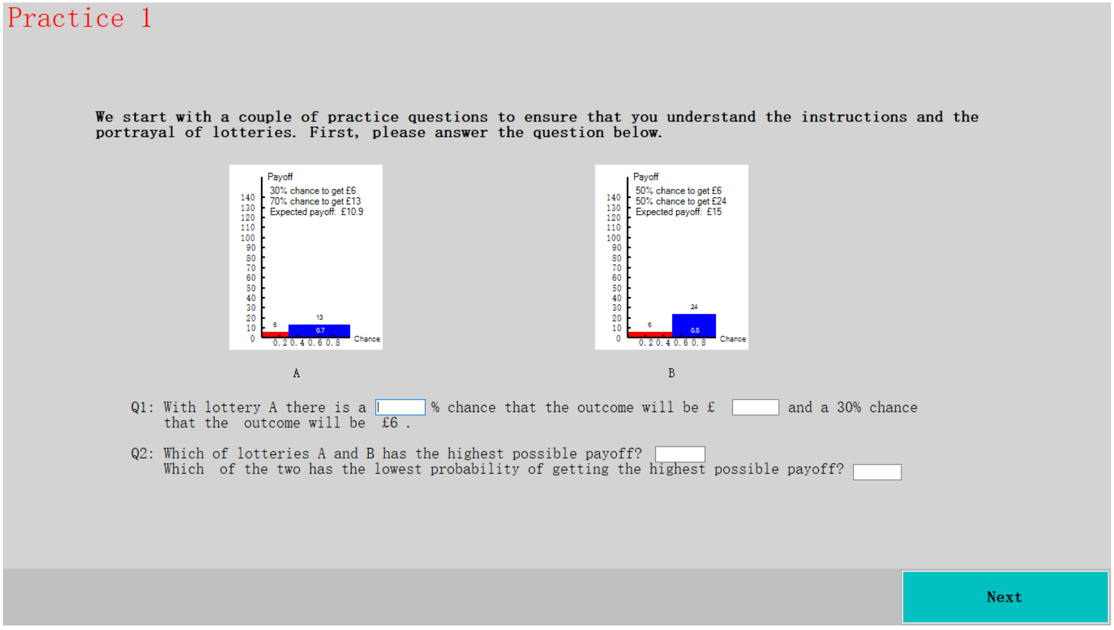
Lihui Lin

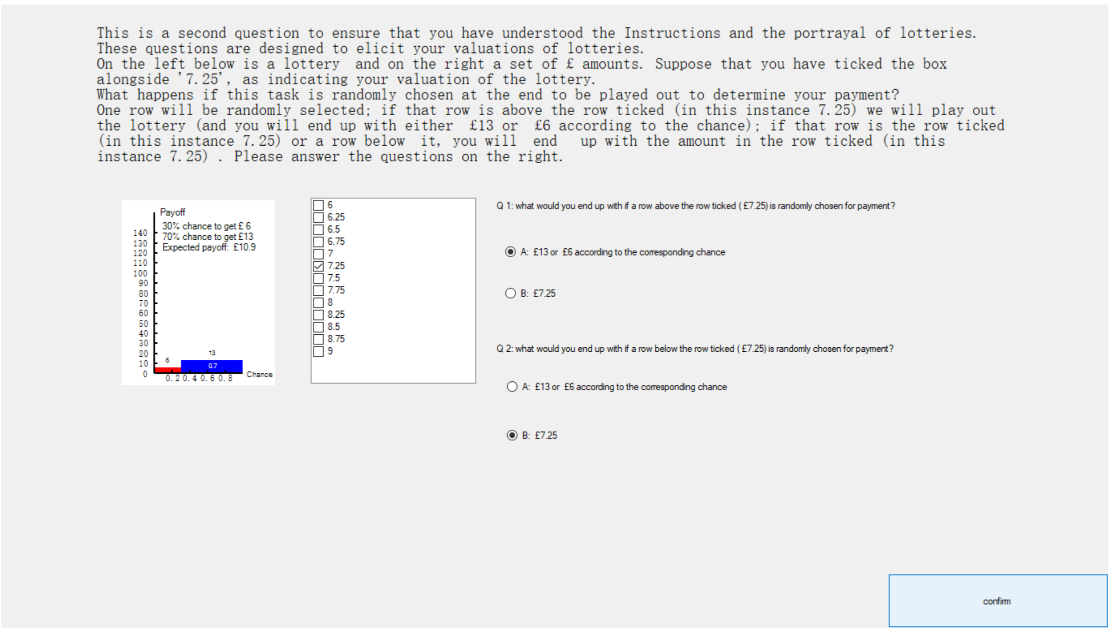
John Hey

May 2021

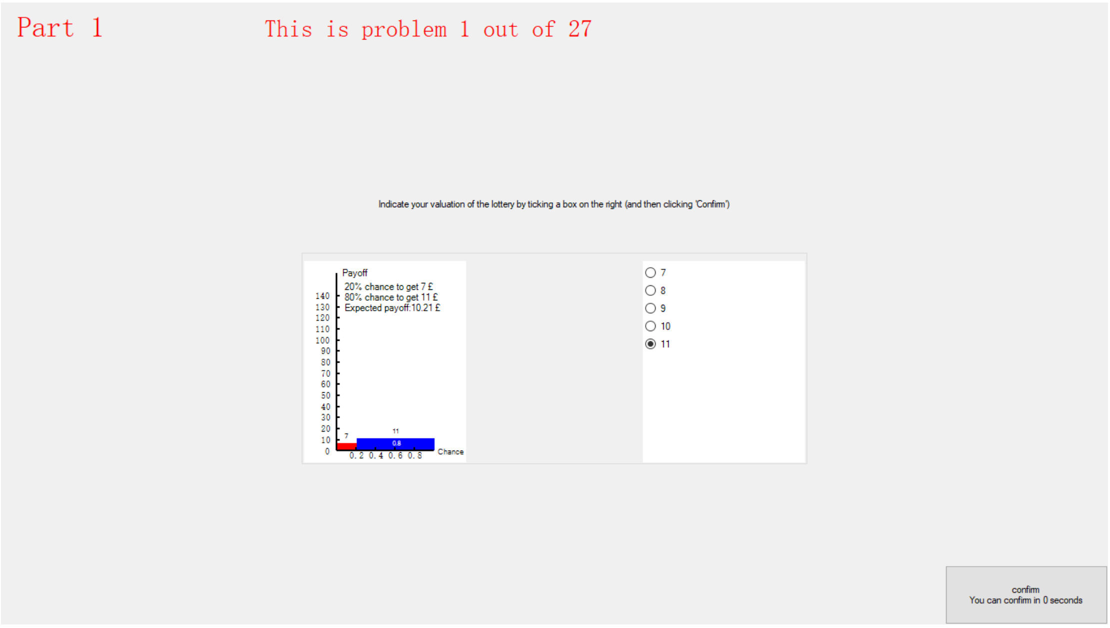
B2: Before Experiment practices

There are two practices before the experiment to make sure subject understand the lottery and experiment.

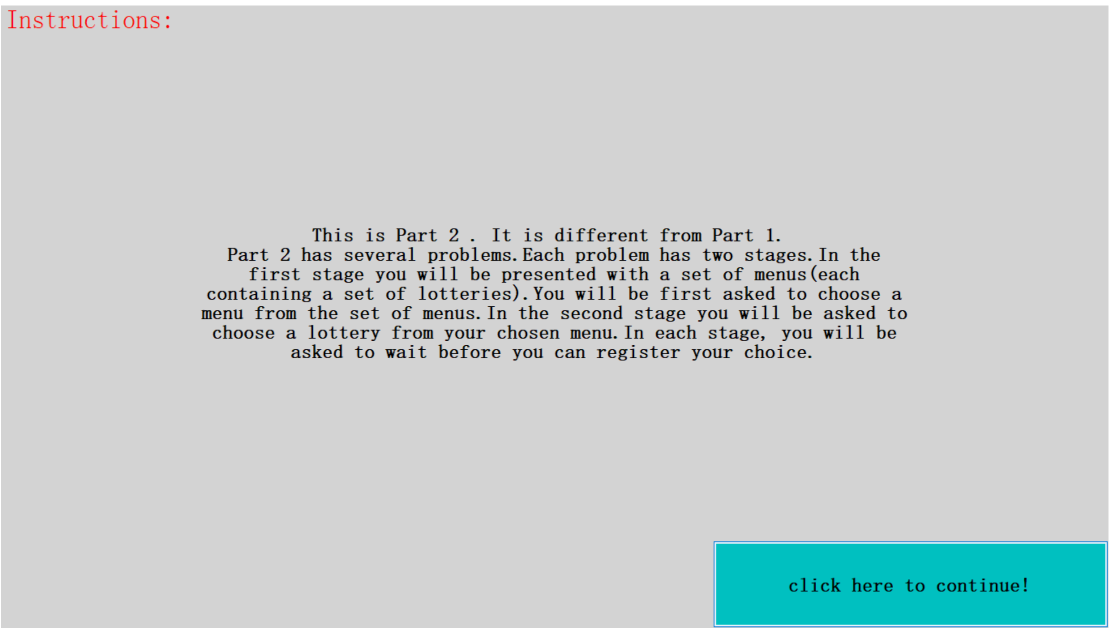


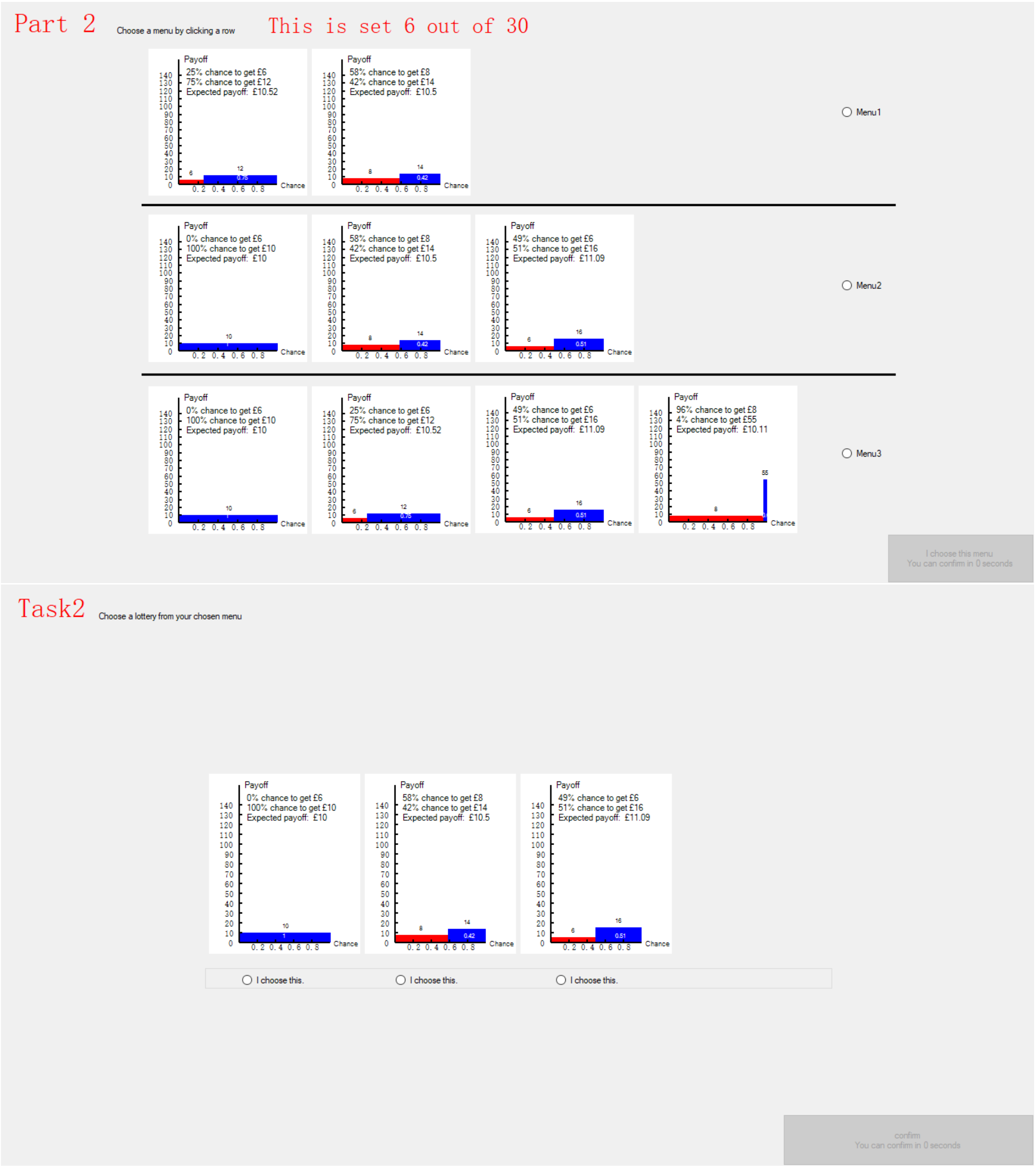


B3: Part 1 screenshot



B3: Part 2 screenshot





Part 2
Choose a menu by clicking a row
This is set 6 out of 30
25% chance to get £6
75% chance to get £12
Expected payoff: £10.52
58% chance to get £8
42% chance to get £14
Expected payoff: £10.5
Menu1
0% chance to get £6
100% chance to get £10
Expected payoff: £10
58% chance to get £8
42% chance to get £14
Expected payoff: £10.5
49% chance to get £6
51% chance to get £16
Expected payoff: £11.09
Menu2
0% chance to get £6
100% chance to get £10
Expected payoff: £10
25% chance to get £6
75% chance to get £12
Expected payoff: £10.52
49% chance to get £6
51% chance to get £16
Expected payoff: £11.09
96% chance to get £8
4% chance to get £55
Expected payoff: £10.11
Menu3
I choose this menu
You can confirm in 0 seconds
Task2
Choose a lottery from your chosen menu
0% chance to get £6
100% chance to get £10
Expected payoff: £10
58% chance to get £8
42% chance to get £14
Expected payoff: £10.5
49% chance to get £6
51% chance to get £16
Expected payoff: £11.09
I choose this.
I choose this.
I choose this.
confirm
You can confirm in 0 seconds