Variance, skewness and multiple outcomes in described and experienced binary prospects: Can one descriptive model capture it all?

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Lotteries and the description–experience gap

Table S1

Lottery Characteristics and the description-experience gap

	Lottery A								Lottery B								$p(A)$		Description–experience gap			
#	p1	p2	p3	p4	v1	v2	v3	v4	p1	p2	p3	p4	v1	v2	v3	v4	Des.	Exp.	Gap	u.b.	l.b.	p
1	20%	80%			20	90			95%	5%			70	110			26%	46%	20%	32%	7%	0.002
2	100%				80				60%	40%			50	120			74%	63%	-11%	1%	-24%	0.090
3	100%				150				50%	50%			100	180			85%	73%				
4	80%	20%			150	20			65%	35%			100	190			22%	38%	16%	30%	2%	0.032
5	40%	60%			200	60			70%	30%			130	100			16%	17%	-1%	9%	-11%	1.000
6	65%	35%			30	20			95%	5%			30	0			68%	41%	27%	42%	12%	0.001
7	70%	30%			130	0			10%	90%			60	100			5%	21%	16%	25%	6%	0.001
8	20%	80%			20	130			10%	90%			110	100			7%	45%	38%	49%	26%	0.000
9	100%				120				25%	75%			0	150			96%	78%	18%	28%	8%	0.000
10	100%				90				70%	30%			70	140			48%	52%	4%	19%	-10%	0.652
11	15%	85%			0	180			30%	70%			60	200			15%	35%	21%	33%	8%	0.001
12	100%				90				45%	55%			70	110			63%	50%	13%	27%	-2%	0.096
13	20%	80%			30	130			85%	15%			100	140			15%	34%	20%	32%	8%	0.001
14	70%	30%			130	80			40%	60%			170	60			89%	81%	-7%	3%	-18%	0.210
15	75%	25%			170	100			65%	35%			190	80			83%	67%	17%	29%	4%	0.009
16	100%				80				20%	80%			150	70			43%	34%	-8%	6%	-23%	0.280
17	75%	25%			170	60			55%	45%			200	100			27%	22%	-5%	8%	-18%	0.500
18	70%	30%			200	60			80%	20%			150	190			7%	19%	11%	21%	2%	0.019
19	100%				60				45%	55%			20	90			86%	81%	5%	18%	-7%	0.473
20	100%				160				25%	75%			70	170			93%	78%	15%	25%	4%	0.007
21	30%	70%			100	150			75%	25%			120	140			46%	54%	8%	24%	-7%	0.322
22	90%	10%			80	50			15%	85%			80	70			47%	63%	16%	30%	1%	0.040
23	80%	20%			40	80			55%	45%			10	90			77%	83%	6%	18%	-6%	0.362
24	15%	85%			0	140			35%	65%			160	80			29%	50%	21%	34%	8%	0.002
25	25%	75%			150	130			80%	20%			170	50			75%	49%	26%	39%	13%	0.000
26	95%	5%			70	0			25%	75%			80	60			21%	54%	33%	46%	21%	0.000
27	5%	95%			120	160			25%	75%			190	150			35%	33%	-2%	13%	-18%	0.888
28	30%	70%			80	170			60%	40%			200	40			83%	67%	17%	30%	3%	0.014
29	70%	30%			150	200			40%	60%			90	190			90%	82%	7%	18%	-4%	0.230
30	50%	50%			10	180			85%	15%			90	150			13%	26%	14%	24%	3%	0.015
31	100%				130				25%	75%			90	160			69%	57%	11%	25%	-2%	0.108
32	70%	30%			70	180			50%	50%			200	10			75%	74%	1%	14%	-12%	1.000
33	15%	85%			20	30			15%	85%			120	10			48%	60%	13%	27%	-2%	0.088
34	70%	30%			190	90			65%	35%			180	100			54%	41%	-14%	1%	-28%	0.066
35	65%	35%			100	60			65%	35%			20	200			82%	75%	-7%	4%	-19%	0.248
36	25%	75%			140	110			85%	15%			110	180			25%	30%	5%	18%	-8%	0.487
37	70%	30%			160	100			45%	55%			120	170			34%	28%	-6%	8%	-20%	0.441

	Lottery A								Lottery B								$p(A)$		Description–experience gap			
#	p1	p2	p3	p4	v1	v2	v3	v4	p1	p2	p3	p4	v1	v2	v3	v4	Des.	Exp.	Gap	u.b.	l.b.	p
38	40%	60%			140	120			45%	55%			90	180			77%	67%	10%	24%	-3%	0.132
39	45%	55%			150	90			85%	15%			90	200			71%	69%	-2%	12%	-16%	0.871
40	85%	15%			190	20			40%	60%			200	120			29%	48%	19%	34%	4%	0.015
41	60%	40%			90	40			45%	55%			0	120			99%	79%	20%	29%	11%	0.000
42	75%	25%			110	50			25%	75%			180	80			46%	35%	-10%	5%	-26%	0.212
43	30%	70%			110	180			70%	30%			140	190			54%	40%	-15%	1%	-30%	0.070
44	85%	15%			160	10			30%	70%			70	170			36%	34%	-2%	14%	-18%	0.890
45	100%				110				95%	5%			100	170			45%	82%	38%	51%	24%	0.000
46	25%	75%			40	160			70%	30%			110	160			15%	32%	18%	29%	6%	0.002
47	100%				80				50%	50%			30	130			89%	70%				
48	15%	85%			90	70			50%	50%			120	20			76%	76%	0%	13%	-13%	1.000
49	15%	85%			70	160			25%	75%			180	140			11%	30%	19%	31%	6%	0.004
50	25%	75%			50	150			5%	95%			140	120			8%	30%	22%	33%	11%	0.000
51	60%	40%			60	10			85%	15%			30	70			45%	43%	-2%	14%	-18%	0.890
52	5%	95%			90	190			25%	75%			80	200			85%	70%	16%	28%	3%	0.014
53	85%	15%			100	50			55%	45%			120	80			35%	32%	-3%	11%	-17%	0.755
54	95%	5%			130	140			90%	10%			140	110			58%	18%	41%	54%	27%	0.000
55	70%	30%			140	0			40%	60%			180	60			18%	16%	-2%	9%	-13%	0.839
56	100%				130				5%	95%			110	140			39%	19%	20%	32%	7%	0.002
57	55%	45%			0	160			60%	40%			100	50			4%	13%	-8%	0%	-17%	0.057
58	85%	15%			90	30			80%	20%			100	20			44%	36%	7%	22%	-7%	0.371
59	40%	60%			100	150			5%	95%			150	140			7%	21%	14%	24%	3%	0.011
60	30%	70%			80	150			80%	20%			140	80			39%	46%	7%	23%	-8%	0.401
61	55%	5%	15%	25%	170	70	60	40	40%	35%	15%	10%	110	60	180	130	36%	41%	4%	18%	-10%	0.644
62	20%	10%	5%	65%	160	70	40	50	10%	5%	60%	25%	150	140	70	40	53%	55%	-2%	12%	-17%	0.880
63	15%	15%	30%	40%	130	160	140	120	5%	45%	35%	15%	180	70	190	160	86%	76%	10%	21%	0%	0.064
64	15%	40%	30%	15%	80	60	160	140	25%	30%	15%	30%	30	140	80	130	53%	68%	-15%	0%	-29%	0.059
65	10%	45%	25%	20%	100	120	20	40	55%	10%	10%	25%	60	160	190	20	68%	65%	-3%	11%	-18%	0.761
66	20%	30%	10%	40%	170	70	200	120	50%	15%	20%	15%	90	100	150	180	66%	46%	-20%	-5%	-34%	0.008
67	100%				60				30%	5%	60%	5%	180	50	0	30	88%	94%	6%	16%	-3%	0.238
68	30%	5%	15%	50%	190	150	110	120	35%	45%	15%	5%	200	110	70	140	73%	67%	-6%	8%	-20%	0.430
69	100%				110				25%	15%	30%	30%	180	60	130	20	90%	82%	7%	18%	-4%	0.230
70	100%				130				35%	10%	15%	40%	120	140	70	180	60%	48%	13%	27%	-2%	0.088
71	10%	30%	10%	50%	30	180	50	150	35%	15%	15%	35%	150	120	0	160	79%	64%	16%	29%	3%	0.020
72	100%				110				5%	50%	25%	20%	100	20	200	180	84%	85%	1%	11%	-9%	1.000
73	5%	50%	30%	15%	120	100	60	90	20%	10%	40%	30%	130	0	30	190	81%	64%	-18%	-6%	-30%	0.003
74	100%				20				5%	75%	15%	5%	180	0	80	20	74%	80%	6%	17%	-4%	0.286

	Lottery A								Lottery B								$p(A)$		Description–experience gap			
#	p1	p2	p3	p4	v1	v2	v3	v4	p1	p2	p3	p4	v1	v2	v3	v4	Des.	Exp.	Gap	u.b.	l.b.	p
75	25%	30%	15%	30%	190	0	20	150	50%	15%	15%	20%	70	130	200	10	22%	32%	10%	24%	-3%	0.132
76	25%	5%	20%	50%	180	170	0	200	20%	20%	25%	35%	40	190	150	200	29%	23%	-6%	6%	-19%	0.377
77	10%	10%	10%	70%	180	10	170	100	15%	15%	30%	40%	170	160	80	90	64%	48%	-16%	0%	-31%	0.053
78	20%	30%	35%	15%	200	170	80	0	35%	15%	30%	20%	120	0	150	200	19%	32%	-14%	0%	-27%	0.053
79	35%	35%	25%	5%	60	80	90	180	10%	10%	35%	45%	60	90	160	20	68%	72%	4%	17%	-9%	0.618
80	40%	15%	10%	35%	200	10	110	30	45%	20%	10%	25%	40	200	90	120	47%	38%	-9%	6%	-24%	0.243
81	10%	10%	10%	70%	140	40	80	160	15%	25%	20%	40%	190	130	80	120	51%	57%	6%	21%	-8%	0.451
82	100%				120				55%	10%	25%	10%	140	50	130	60	81%	65%	17%	28%	5%	0.005
83	5%	60%	20%	15%	80	190	70	90	40%	5%	25%	30%	100	110	150	170	36%	28%	-8%	6%	-23%	0.291
84	20%	25%	50%	5%	40	60	160	80	10%	55%	30%	5%	170	120	110	0	47%	29%	18%	33%	3%	0.021
85	10%	25%	30%	35%	150	120	60	40	25%	30%	40%	5%	30	20	140	120	53%	67%	-14%	1%	-28%	0.072
86	40%	35%	20%	5%	60	90	170	130	25%	15%	20%	40%	60	130	180	40	72%	70%	-2%	12%	-16%	0.878
87	5%	70%	20%	5%	80	70	170	140	15%	15%	40%	30%	140	50	150	0	84%	81%	3%	15%	-9%	0.711
88	35%	35%	5%	25%	80	20	170	190	20%	45%	20%	15%	50	160	60	10	33%	44%	-10%	4%	-25%	0.164
89	10%	60%	15%	15%	170	130	30	140	25%	65%	5%	5%	60	140	40	160	64%	50%	-14%	1%	-28%	0.079
90	35%	5%	50%	10%	60	190	200	40	5%	15%	40%	40%	100	70	120	160	39%	34%	-4%	10%	-19%	0.652
91	10%	5%	70%	15%	90	140	70	170	15%	35%	40%	10%	60	70	140	40	55%	52%	3%	18%	-12%	0.771
92	20%	25%	10%	45%	150	70	120	170	25%	20%	25%	30%	180	170	120	90	46%	32%	-14%	0%	-27%	0.060
93	5%	10%	30%	55%	200	170	40	130	5%	15%	10%	70%	190	120	10	110	39%	57%	-19%	-3%	-35%	0.022
94	25%	20%	50%	5%	140	10	70	20	15%	45%	15%	25%	40	100	10	70	43%	54%	-11%	4%	-27%	0.169
95	45%	30%	10%	15%	180	120	140	80	10%	55%	10%	25%	90	170	140	100	39%	43%	-4%	11%	-19%	0.659
96	20%	60%	10%	10%	180	130	80	170	5%	45%	35%	15%	110	150	130	80	75%	57%	18%	33%	3%	0.021
97	100%				130				45%	10%	25%	20%	160	0	120	200	64%	38%	26%	39%	13%	0.000
98	45%	25%	10%	20%	200	80	60	120	5%	65%	15%	15%	180	170	110	120	15%	25%	-10%	0%	-21%	0.052
99	5%	60%	25%	10%	190	60	130	80	10%	10%	50%	30%	160	70	120	0	83%	67%	17%	28%	5%	0.005
100	40%	15%	10%	35%	20	160	120	90	45%	10%	5%	40%	50	130	150	90	33%	38%	-4%	10%	-19%	0.652
101	40%	30%	25%	5%	30	40	170	200	55%	10%	20%	15%	50	80	90	110	47%	39%	8%	23%	-6%	0.302
102	10%	40%	40%	10%	20	120	50	30	10%	55%	10%	25%	150	20	50	160	52%	60%	8%	22%	-5%	0.256
103	10%	10%	30%	50%	160	20	10	60	15%	20%	25%	40%	10	130	30	50	41%	35%	5%	19%	-9%	0.533
104	15%	20%	20%	45%	180	100	140	130	35%	10%	30%	25%	160	120	70	180	82%	56%	26%	39%	13%	0.000
105	100%				80				10%	70%	15%	5%	30	80	170	0	70%	65%	-5%	8%	-18%	0.487
106	10%	5%	30%	55%	80	60	190	100	30%	15%	50%	5%	170	20	130	10	73%	66%	7%	21%	-6%	0.337
107	100%				160				5%	10%	10%	75%	50	200	10	170	81%	65%	17%	30%	3%	0.014
108	15%	15%	10%	60%	80	10	170	200	15%	30%	15%	40%	150	90	120	190	43%	41%	-2%	12%	-17%	0.880
109	55%	25%	15%	5%	80	100	160	110	30%	10%	20%	40%	150	110	40	70	81%	79%	2%	14%	-10%	0.856
110	30%	20%	20%	30%	110	150	80	140	30%	15%	30%	25%	120	30	100	190	71%	60%	10%	25%	-5%	0.193
111	5%	80%	10%	5%	10	70	130	110	40%	5%	40%	15%	40	60	120	10	77%	77%	0%	12%	-12%	1.000

	Lottery A								Lottery B								$p(A)$		Description–experience gap			
#	p1	p2	p3	p4	v1	v2	v3	v4	p1	p2	p3	p4	v1	v2	v3	v4	Des.	Exp.	Gap	u.b.	l.b.	p
112	55%	20%	5%	20%	160	190	180	0	10%	10%	30%	50%	20	90	140	170	20%	23%	3%	14%	-8%	0.690
113	35%	30%	10%	25%	180	80	130	150	15%	5%	75%	5%	180	30	130	170	43%	42%	1%	16%	-14%	1.000
114	100%				130				35%	10%	30%	25%	180	170	120	100	46%	36%	-9%	5%	-24%	0.233
115	10%	25%	5%	60%	120	90	30	100	5%	25%	50%	20%	40	120	100	30	73%	68%	5%	19%	-8%	0.511
116	75%	10%	5%	10%	90	180	100	70	5%	15%	25%	55%	70	30	120	110	53%	33%	20%	34%	6%	0.005
117	15%	10%	25%	50%	170	30	140	200	30%	5%	25%	40%	170	30	140	180	61%	49%	-13%	2%	-27%	0.111
118	35%	10%	50%	5%	140	80	190	40	5%	65%	10%	20%	0	200	40	100	72%	51%	21%	37%	5%	0.012
119	50%	20%	5%	25%	130	140	200	120	10%	10%	15%	65%	0	150	50	160	88%	72%	16%	28%	3%	0.017
120	10%	70%	15%	5%	90	10	140	130	10%	5%	5%	80%	70	0	60	40	53%	43%	10%	25%	-5%	0.193

Table S2

Descriptive statistics for the average gap size (%) conditional on the number of outcomes, existence of a rare event, and difference in prospect skewness

(a) *For simple lotteries, by rare event defined as $p \leq 0.1$ or $p \leq 0.2$*

	$p \leq 0.1$		$p \leq 0.2$	
Rare event?	No	Yes	No	Yes
Average gap	5.8	22.8	3.0	14.6
Lower 95%	2.6	16.1	-1.2	10.5
Upper 95%	9.0	28.9	7.3	19.0
# of observations	47	13	27	33

(b) *Simple and complex lotteries by tertiles of absolute skewness difference*

	Simple			Complex		
Abs. skewness diff.	High	Moderate	Low	High	Moderate	Low
Average gap	11.1	6.7	11.2	8.0	-2.3	-1.0
Lower 95%	5.9	1.1	4.9	4.0	-7.3	-5.6
Upper 95%	16.4	11.5	18.6	11.9	4.1	3.4
# of observations	20	20	20	20	20	20

Prevalence of general-types across all niches

Consider the set of possible participant types (over all four environmental niches), defined as the combination of the (most likely) decision models used by a participant per niche—we refer to this as the general-type, see Table S3. From the set of $5^4 = 625$ possible general-types, five are consistent with decision makers who did not adapt to environments insofar as they used the same decision model in all four environments (permitting however for parameter heterogeneity). The other general-types are consistent with decision makers who did adapt, meaning that they used more than one decision model. Thus defined, the vast majority of our participants (90%) were environment-contingent makers and only 10% of our participants were not, using CPT in all four environments. The most prevalent general-type of participant (14%) was CPT in DS, DES in DC and ES, and MVS in EC. The next most prevalent (10%) was the CPT general-type and the one using CPT in DS, DES in DC, EU in ES, and MVS in EC. All other general-types corresponded to 10% or less of the population and typically involve some other combination of CPT, DES and MVS across environments.

Table S3

General-types of the probabilistic models

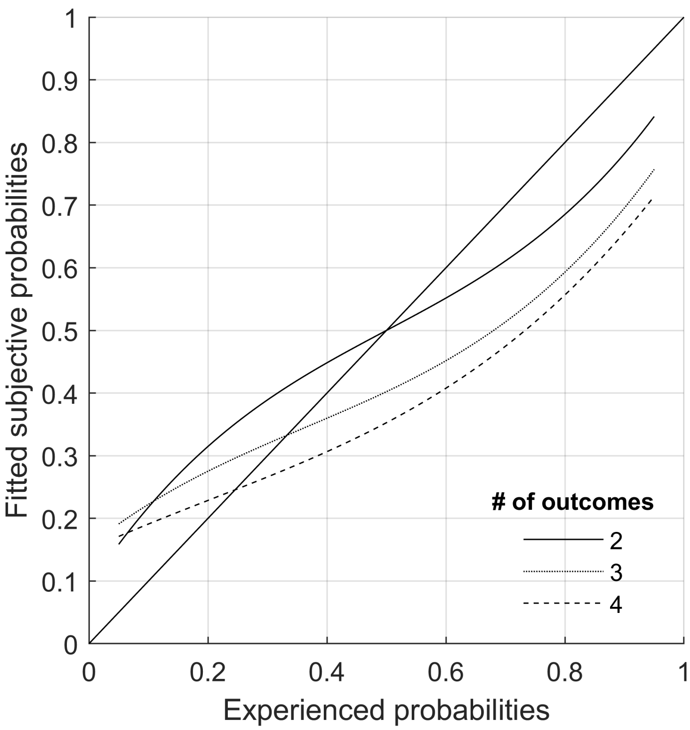
Prevalence	DS	DC	ES	EC	Prevalence	DS	DC	ES	EC
14%	CPT	DES	DES	MVS	1%	CPT	MVS	CPT	CPT
10%	CPT	CPT	CPT	CPT	1%	CPT	CPT	N-CPT	CPT
10%	CPT	DES	EU	MVS	1%	CPT	CPT	MVS	CPT
8%	CPT	DES	CPT	MVS	1%	N-CPT	CPT	MVS	CPT
4%	CPT	DES	CPT	CPT	1%	CPT	DES	EU	CPT
4%	CPT	CPT	CPT	MVS	1%	N-CPT	CPT	EU	N-CPT
4%	CPT	CPT	DES	MVS	1%	N-CPT	N-CPT	EU	N-CPT
3%	CPT	DES	DES	CPT	1%	CPT	CPT	DES	DES
3%	CPT	DES	MVS	MVS	1%	N-CPT	CPT	CPT	MVS
3%	CPT	CPT	EU	MVS	1%	N-CPT	DES	CPT	MVS
2%	N-CPT	DES	CPT	CPT	1%	N-CPT	MVS	CPT	MVS
2%	CPT	CPT	DES	CPT	1%	N-CPT	CPT	DES	MVS
2%	CPT	MVS	DES	MVS	1%	N-CPT	N-CPT	DES	MVS
2%	N-CPT	N-CPT	MVS	MVS	1%	DES	N-CPT	DES	MVS
2%	N-CPT	N-CPT	EU	MVS	1%	N-CPT	DES	DES	MVS
2%	EU	DES	EU	MVS	1%	MVS	DES	DES	MVS
1%	N-CPT	CPT	CPT	CPT	1%	CPT	CPT	MVS	MVS
1%	N-CPT	N-CPT	CPT	CPT	1%	N-CPT	CPT	EU	MVS
1%	MVS	DES	CPT	CPT	1%	N-CPT	DES	EU	MVS

Further findings regarding the elicited probabilities

Figure S1 plots the relationship between the elicited probabilities (fitted with a cubic polynomial) and experienced probabilities averaged over all participants' decisions conditional on the number of experienced outcomes. The participants exhibited conservative probability estimation (overestimation for low and underestimation for high experienced probabilities), a regressive pattern often found in the relevant literature (e.g., Edwards, 1968; Erev et al., 1994; Rapoport & Wallsten, 1972; Spiliopoulos, 2012).[1]

Figure S1

Subjective versus experienced probabilities per number of outcomes



We also investigate the relationship between statistical numeracy/risk literacy and behavior. Participants could score from zero to four on the Berlin Numeracy Test, corresponding to the number of questions they answered correctly (denoted as B_c). The mean of B_c is 1.6 (s.d.=1.2) and the distribution of B_c for 0, 1 2, 3, and 4 correct answers is 22%, 25%, 24%, 24%, and 5%, respectively. These results are representative of those arising from the general population (Cokely et al., 2012).

Let B_{rt} be the time taken to answer all tests. First, we regress the average time taken by a participant to complete the description lotteries (RT_{DFD}) on these variables and the participant classification to the decision models in the relevant treatments. Second, we regress the mean absolute deviation or error in the elicited probabilities versus the experienced probabilities, ε_p. The average ε_p over all participants was 9.1% (s.d.=2.7%); this fairly high level of accuracy

[1] It is not clear whether this relationship arises because participants attempt to report experienced probabilities (with some distortion, perhaps arising from noisy retrieval/memory) or because they are trying to account for sampling biases in their limited experience with respect to the objective probabilities. While an interesting question in its own right, it is not central to our goal here—we are interested in testing whether participants' elicited beliefs are more informative than the experienced probabilities, regardless of how the former may be derived from the sampling experience.

indicates that participants were adequately motivated. This error compares favourably to those from other studies such as Study 2 in Hau et al. (2008), where despite participants estimating only one probability from one risky prospect, the error rate was 8.5%. Findings are presented in Table S4. We find that response time in the description treatment was significantly longer the more time a participant spent on the Berlin Numeracy Test, but found no other significant variables.

By contrast, a perfect score in the Berlin Numeracy Test was associated with a significantly smaller error in probability judgment (approximately 30% lower). Unexpectedly, a larger number of samples was associated with a higher error. One explanation is that this leads to a larger number of sampled outcomes, thereby increasing the complexity of probability judgment.

Table S4

Truncated regressions of RT_{DFD} and ε_p on Berlin Numeracy Test results

	RT_{DFD}	ε_p
$B_c = 1$	-3.12	-0.70
	(2.63)	(0.69)
$B_c = 2$	0.18	-0.77
	(2.53)	(0.66)
$B_c = 3$	0.38	-1.24
	(2.55)	(0.82)
$B_c = 4$	2.38	-4.18***
	(2.86)	(1.02)
B_{rt}	0.014**	0.002
	(0.005)	(0.001)
#s		0.11***
		(0.03)
3.DS	-0.80	
	(2.53)	
2.DC	2.50	
	(1.57)	
3.DC	0.49	
	(4.15)	
2.ES		
3.ES		
2.EC		
3.EC		
c	7.65*	7.06***
	(3.02)	(1.01)
N	96	96

*=0.05, **=0.01,***=0.001

Experimental instructions and details

We ran a pilot study with 15 participants to observe the degree of sampling for various levels of enforced time delay between samples (i.e., the amount of time that had to pass before the participant could sample again). Participants in the experience and belief elicitation treatments were shown each sampled outcome for one second, followed by a time delay during which they could not sample, in order to allow them enough time to attend to the sampled outcome and encode it in memory. A low time delay (0.25s) was determined to be too short, whilst a high time delay (1s) slowed down sampling too much, leading to a smaller number of samples compared to the existing literature. We concluded that a time delay of 0.5s was the optimal tradeoff.

Eight participants were not included in the reported analyses, five due to technical issues and three on the basis of their behavior. Of the five participants who encountered technical issues, three were excluded because a display error in the code appeared during the experiment. The cause of the error was fixed for the remainder of the participants. Other participants, who did not encounter the error, were kept in the analysis, as we were able to ascertain with certainty from the detailed event-by-event logs produced by E-Prime software that they were not affected. One participant discovered a way to bypass the time restriction on the sampling delay (by right-clicking instead of left-clicking) and was excluded. Again, studying the detailed logs we were able to ascertain that none of the other participants had employed the right-click before we modified the experimental code to exclude this. Finally, one participant was excluded as the data file for the experience treatment was missing.

We decided to exclude three participants who on average sampled five or fewer times per lottery as the experienced probabilities of outcomes were necessarily constrained (at best) to multiples of 0.20, and more often than not to much larger multiples, particularly for lotteries with four outcomes. This constraint is too coarse for the proper estimation of probability weighting functions, and generally indicates a lack of engagement with the experiment, as the average number of samples is much higher, 19.4. Furthermore, such frugal sampling would severely restrict the experienced number of lottery outcomes, turning almost all lotteries in the experience treatment into simple experienced lotteries and making a comparison of simple versus complex lotteries in this treatment impossible.

Description and experience treatment details

To avoid a bias towards choosing or sampling from a specific lottery, the mouse pointer was positioned midway between the two onscreen buttons (for left and right prospects) and was returned there after every selection (either sampling or final lottery choice).

Instructions

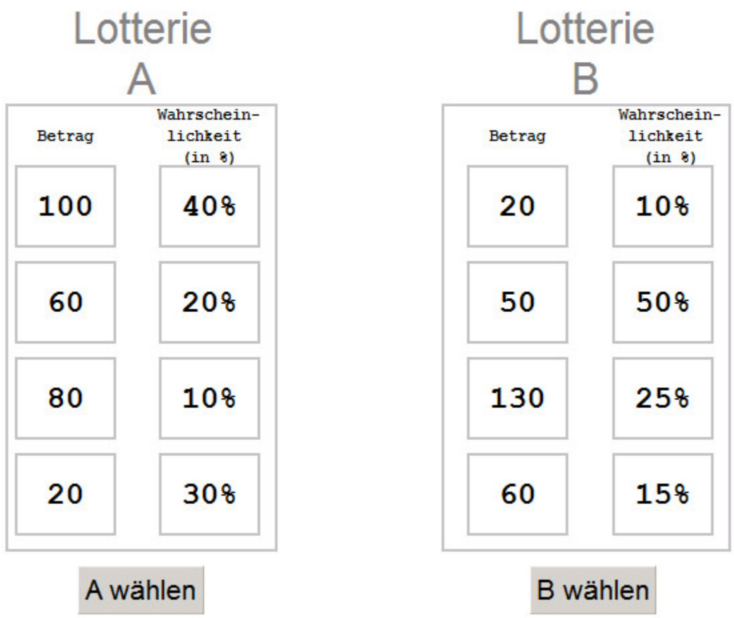
Participants were presented with the instructions in German—we present the English translations below.

Description treatment

First screen. Thank you very much for your interest in participating in this study! Our goal is to get a better understanding of how people make decisions. Different tasks will be presented to you on the screen. You will have to inform yourself about the prospects in order to make a decision. Please try to do your best in each task.

Press ENTER to proceed.

Second screen. You will be shown 120 lottery pairs. Each lottery offers different possible amounts with their respective probabilities. This information is presented to you as follows (see below):



On the left you see the information for lottery A and on the right for lottery B. For each lottery, the amounts (left column) and the associated probabilities (right column) are displayed. For each lottery pair, indicate whether you prefer Lottery A or B. There is no right or wrong answer. The decision depends solely on your personal preference. If you prefer Lottery A, please press "Select A". If you prefer Lottery B, please press "Select B". Then you will be shown the next lottery pair.

Press ENTER to continue.

Third screen. At the end of the experiment, two of the 120 lottery pairs you were comparing will be randomly drawn by the computer. Each of the lottery pairs is equally likely to occur. The outcome of the lotteries will be determined by two things.

1. The specific lottery you chose for each of the lottery pairs drawn above.
2. The outcome for each lottery, which is also randomly drawn by the computer. The outcome will be chosen according to the lottery probabilities.

The two lotteries that have been randomly chosen will then be paid out. The payoffs in experimental units from these two lotteries will be converted into a real amount of money (euro) at the following rate: 20 points equal 1 euro. Since your individual choices influence the real amount which will be paid to you by the end of the experiment, you should approach each pair of lotteries as if it is one out of those that will be played at the end.

Press ENTER to proceed.

Fourth screen [Repeat same screenshot as above]. For example, assume that the lottery pair presented here was randomly drawn by the computer to be played. Now suppose you had chosen Lottery A from this lottery pair, and the computer randomly draws the second outcome. The corresponding points for this outcome are 60. You would then receive an additional payment of $60/20 = 3$ euro from this lottery. Recall that 20 experimental units equal 1 euro.

Press ENTER to proceed.

Fifth screen. To summarize, your earnings are determined by three things:

- the two lottery pairs chosen to be played that are drawn at random by the computer
- the lottery you selected, the left or the right, for each of these two pairs
- the outcome of each lottery drawn at random by the computer

If you have understood these instructions, then please press ENTER to proceed to the beginning of the experiment. Otherwise, raise your hand and the experimenter will answer any questions you may have before beginning the experiment.

Experience treatment

First screen. Thank you very much for your interest in participating in this study! Our goal is to get a better understanding of how people make decisions. Different tasks will be presented to you on the screen. You will have to inform yourself about the prospects in order to make a decision. Please try to do your best in each task.

Press ENTER to proceed.

Second screen. Hereafter you will see 120 pairs of lotteries. Imagine each of the lotteries as an urn that contains balls with different values. By pressing the mouse button on the lottery you can draw one ball from the urn and examine its value. After each drawing the ball is placed back into the urn. By drawing from the urn you get an impression of the expectancy of values and how often these values appear. You can draw as many samples from the urn as you would like.

Press ENTER to proceed.

Third screen. Please inform yourself about each lottery by drawing any desired amount of samples. To do so click on the button ‘draw sample’ underneath each lottery. The value of the sample will be presented on the screen for 1 second. Each lottery has different values and frequencies even if some lotteries may seem to be similar. If you think you have a sufficiently precise impression of the lotteries then you can make your choice. There is no right or wrong answer, your decision is a matter of taste. If you prefer Lottery A then you should click on the button “Choose A” or if you prefer Lottery B on the button “Choose B”. You will then be presented with the next lottery pair.

Press ENTER to proceed.

Fourth screen. At the end of the experiment, four of the 120 lottery pairs you were comparing will be randomly drawn by the computer. Each of the lottery pairs is equally likely to occur. The outcome of the lotteries will be determined by two things.

1. The specific lottery you chose for each of the lottery pairs drawn above.
2. The outcome for each lottery, which is also randomly drawn by the computer. The outcome will be chosen according to the lottery probabilities.

The four lotteries that have been randomly chosen will then be paid out. The payoffs in experimental units from these four lotteries will be converted into a real amount of money (euro) at the following rate: 20 points equal 1 euro. Since your individual choices influence the real amount which will be paid to you by the end of the experiment, you should approach each pair of lotteries as if it is one out of those that will be played at the end.

Press ENTER to proceed.

Fifth screen [Repeat same screenshot as above]. For example, assume that the lottery pair presented here was randomly drawn by the computer to be played. Now suppose you had chosen Lottery A from this lottery pair, and the computer randomly draws the second outcome. The corresponding points for this outcome are 60. You would then receive an additional payment of $60/20 = 3$ euro from this lottery. Recall that 20 experimental units equal 1 euro.

Press ENTER to proceed.

Sixth screen. To summarize, your earnings are determined by three things:

- the four lottery pairs chosen to be played that are drawn at random by the computer
- the lottery you selected, the left or the right, for each of these two pairs
- the outcome of each lottery drawn at random by the computer

If you have understood these instructions, then please press ENTER to proceed to the beginning of the experiment. Otherwise, raise your hand and the experimenter will answer any questions you may have before beginning the experiment.

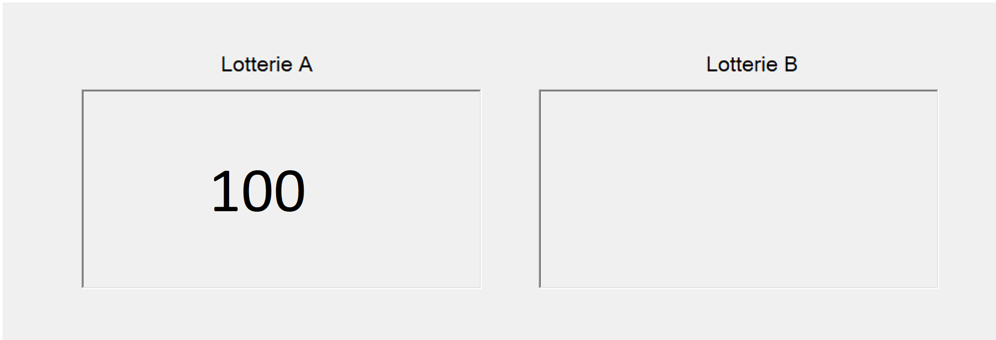
Belief elicitation treatment

First screen. Thank you for participating in this experiment! Our goal is to get a better understanding of how people make decisions. Different tasks will be presented to you on the screen. Please try to do your best in each task.

Press ENTER to proceed.

Second screen. Hereafter you will see 120 pairs of lotteries. Imagine each of the lotteries as an urn that contains balls with different values. The computer will automatically draw balls from the urns and show you their value. After each draw the ball is placed back into the urn. By observing the outcomes of the draws from the urns you get an impression of the value of the outcomes and how often these outcomes occur. You should pay careful attention to these draws and remember that each lottery is different.

The screenshot below is an example of what you will see each time a ball is drawn from one of the urns.



Press ENTER to proceed.

Third screen. After the computer stops presenting the outcomes of a lottery pair, you will be asked to estimate the associated probabilities of the outcomes for each of the lotteries in the pair. A table (like the one below) will be displayed where you will fill in your estimates separately for Lottery A and Lottery B. The value of the outcomes that you have observed will automatically be filled in. Next to each outcome you must enter your best estimate of the likelihood of that outcome occurring in the respective lottery.

Please note that the sum of the likelihoods that you enter for each lottery must sum to 100%. If not, you will be reminded and allowed to adjust your estimates before proceeding to the next lottery pair. Please note, you are allowed to enter probabilities only in increments of 5% (i.e., 5%, 10%, 15%, 20% etc).

Lottery A		Lottery B	
Outcomes	Probabilities (in %)	Outcomes	Probabilities (in %)
100		20	
60		50	
80		130	
20		60	

Fourth screen. If you have understood these instructions, then please press ENTER to proceed to the beginning of the experiment. Otherwise, raise your hand and the experimenter will answer any questions you may have before beginning the experiment.

Berlin numeracy test

1. Imagine we are throwing a five-sided die 50 times. On average, out of these 50 throws how many times would this five-sided die show an odd number (1, 3 or 5)?

____________ out of 50 throws.

2. Out of 1,000 people in a small town 500 are members of a choir. Out of these 500 members in the choir 100 are men. Out of the 500 inhabitants that are not in the choir 300 are men. What is the probability that a randomly drawn man is a member of the choir? (please indicate the probability in percent).

_________________ %

3. Imagine we are throwing a loaded die (6 sides). The probability that the die shows a 6 is twice as high as the probability of each of the other numbers. On average, out of these 70 throws, how many times would the die show the number 6?

_________________ out of 70 throws.

4. In a forest 20% of mushrooms are red, 50% brown and 30% white. A red mushroom is poisonous with a probability of 20%. A mushroom that is not red is poisonous with a probability of 5%. What is the probability that a poisonous mushroom in the forest is red?

____________________%

Scoring = Count total number of correct answers. Correct answers are as follows: 1 = 30; 2 = 25; 3 = 20; 4 = 50.

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