Supplementary Materials:

Schley, D. R. & Peters, E. Assessing “economic value”: Symbolic-number mappings predict risky and riskless valuations

1. Data Collection Methods Common to All Studies

In all studies, we collected variables to measure the curvature of the value function and the accuracy of mapping symbolic numbers to underlying magnitudes (as described in the main text). In addition, we used the 8-item numeracy scale developed by Weller et al. (2013). We collected data about participants' age (using a free response measure) and gender (1 = male, 2= female). To assess education, we asked participants to self-report their education level (1= some high school, 2= high school/GED, 3 = some college/ 2 year degree, 4 = 4 year degree, 5 = some graduate school, 6 = graduate degree). We also assessed self-reported income (1 = <$20,000, 2 = $20,000-$39,999, 3 = $40,000-$59,999, 4 = $60,000-$99,999, 5 = $100,000-$199,999, 6 = >$200,000) and race/ethnicity. In each study, the goal was to recruit between 75 and 100 participants. Data collection stopped once the number of participants recruited was within the acceptable range. We did not delete any participants from any of the studies.

2. Study 1a: Replication of Study 1 with a non-numeric response scale

Participants (N=81, 50.6% female, M_{age} = 35.7, range 18-71 years) were recruited online from Mechanical Turk and completed a task nearly identical to that of Study 1. The only difference was in the WTD response format. In Study 1a, participants indicated their WTD on a 120mm long slider anchored at "none" and "the furthest you have ever driven in a day," such that the former produced a value of 0 in the data, and the latter produced a value of 100. We chose these endpoints to avoid ceiling effects found in earlier pilot tests.

In each of the three experiments reported here and in the main text, more than 80% of the sample was white; therefore, we did not investigate the role of race in valuations. Results of Study 1a were analyzed in the same manner as those of Study 1. To again test our hypothesis (that more linear value functions would be associated with more exact symbolic-number mappings), we created a log-log MLM, predicting participants' WTD responses using dollar amounts, symbolic-number-mapping scores, and their interactions as explanatory variables. We controlled for age, gender, education, and income, none of which had significant unique effects on DMU, ps > .50 (see Table S1). The slope coefficient of dollar amounts on WTD responses, $\beta = 0.82$, $t(873) = 23.51$, $p < .0001$, indicated the presence of DMU. Results indicated an interaction between objective dollar amounts and participants' symbolic-number mappings in WTD predictions, $\beta = 0.15$, $t(874) = 3.87$, $p < .0001$. Participants with more exact symbolic-number mappings again exhibited less DMU than those with less exact mappings. We then removed participants' symbolic-number-mapping scores and added numeracy scores and their interaction with dollar amounts into the MLM. Results indicated an interaction between objective dollar amounts and numeracy in WTD predictions, $\beta = 0.04$, $t(874) = 1.77$, $p = .08$. Specifically, more numerate participants exhibited less DMU than less numerate participants.

When symbolic-number-mapping scores were added back into the MLM, their influence remained significant, $\beta = 0.14$, $t(873) = 3.36$, $p = .0008$, and the influence of numeracy became non-significant, $\beta = 0.00$, $t(873) = 0.17$, $p = .86$.

Table S1. Correlation table for variables used in Study 1a.

	VF_Exp	SymMap	Numeracy	Gender	Age	Income	Education
VF_Exp	1.00						
SymMap	.40**	1.00					
Numeracy	.17	.50***	1.00				
Gender	.06	.07	-.01	1.00			
Age	-.01	.10	.18	.13	1.00		
Income	-.00	-.02	.00	.16	.08	1.00	
Education	.04	.24*	.35**	.16	.10	.14	1.00

Gender is coded as 1 = male and 2 = female. VF_Exp refers to participants' value function exponent parameter and SymMap refers to participants' symbolic-number-mapping scores.
*** $p < .0001$; ** $p < .01$; *$p < .05$

As in Study 1, we then exported the slope coefficient of dollar amounts on WTD from the MLM as an individual-difference measure of participants' DMU. Using multiple-regression models identical to those of Study 1 in the main text, results indicated that participants with more exact symbolic-number mappings exhibited less DMU, $\beta = 0.12$, $t(79) = 2.96$, $p = .004$ (Table S3, $r = 0.40$). As in Studies 1 and 2 in the main text, we tested whether the influence of numeracy on DMU was mediated by symbolic-number mappings. First, greater numeracy was related, in one analysis, to more exact symbolic-number mappings, $\beta = 0.24$, $t(79) = 5.09$, $p < .0001$, and, in a second analysis, to less DMU, $\beta = 0.03$, $t(79) = 1.98$, $p = .05$. When the symbolic-number-mapping scores were introduced into the model predicting DMU, the influence of numeracy became non-significant, $\beta = 0.01$, $t(79) = 0.33$, $p = .74$. We then generated 10,000 samples and tested the indirect effect of numeracy on DMU, employing bootstrap 95% confidence intervals (CI). Results indicated a significant indirect effect of numeracy on DMU through symbolic-number mappings, $b_{\text{Indirect}} = 0.028$, CI [.006, .055]. Therefore, Study 1a's results were consistent with those of Study 1 and demonstrate that Study 1's results were not likely a product of participants with less exact mapping ability being less able to respond on a numeric response scale.

3. Additional Results from Study 2 – Loss Aversion and Probability-Weighting-Function Parameters

In Study 2, we assessed Prospect-Theory value-function parameters for each participant. In doing so, we also fit loss aversion and probability-weighting-function parameters. Results indicated no relation between numeracy and loss aversion, $r = -.03$, $p = .75$, but a significant negative correlation between symbolic-number mapping and loss aversion, $r = -.21$, $p = .04$. That is, participants with more accurate mappings of symbolic numbers to their underlying magnitudes exhibited less loss aversion than participants with less accurate mappings; results hold marginally in a multiple-regression model controlling for numeracy, gender, age, income, and education (similar to models 3 and 6 in Table 1 in the main text), $b = -.22$, $t(90) = 1.88$, $p = .06$. The results could be explained by the strong negative correlation between linearity of the value function (over gains and losses) and the extent of loss aversion (e.g., $r = -.68$ in Toubia et al., 2013); we observed a similar relation, $r = -.80$, $p < .0001$. Intuitively, it makes sense that an individual who exhibits more expected-value-consistent choices (i.e., a more linear value function) would also be less influenced by loss aversion (for a similar discussion, see Hsee & Rottenstreich, 2004).

No significant relation existed between the linearity of the probability weighting function and numeracy, $r = -.09$, $p = .40$, or symbolic-number mappings, $r = -.04$, $p = .66$. Given that probabilities are a numeric magnitude, we might have expected greater numeracy and more accurate mappings to be associated with more linear value functions. The nonobservance of this relation does not necessarily mean that it does not exist, however. Rather, it may be a methodological issue in the fitting of Prospect-Theory parameters. Specifically, when fitting Prospect-Theory parameters, the model must account for risk aversion by assuming a more curved value function or a more curved probability weighting function (Fox & Poldrack, 2009).

As a result, a negative relation may emerge between the linearity of the value function and the linearity of the probability weighting function. Consistent with this possibility, Toubia and colleagues (2013) reported a negative correlation of $r = -.21$ between the linearity of the value function and the linearity of the probability weighting function; we observed a similar relation in our data, $r = -.17$, $p = .09$. Thus, the apparent nonobservance of a relation between the linearity of the probability weighting function and numeracy or symbolic-number mapping may be a consequence of how Prospect-Theory parameters are fit. We know from previous research that greater numeracy is associated with greater probability sensitivity (for a review, see Peters, 2012), which would imply more linear probability weighting functions. An alternative explanation is that the negative relation between the linearities of the value and probability weighting functions is due to attentional constraints (i.e., attending to value decreases available attention to probability). Given this interpretation, individuals with more exact mappings, who are more sensitive to value, may have not have shown simultaneous sensitivity to probability due to limited attentional resources. To accurately assess the influence of numeracy and symbolic-number mappings on the probability weighting function, further research should assess the probability weighting function independent of the value function.

4. Summary Statistics for Each Study: Tables S2-S4

Table S2. Summary statistics for the variables used in Study 1

	Mean	Median	STDev	Minimum	Maximum	n
VF_Exp	0.88	0.87	0.23	0.11	1.37	76
SymMap	-3.46	-3.37	0.82	-5.88	-1.85	76
Numeracy	5.05	5.00	2.11	0.00	8.00	76
Gender	1.51	2.00	0.50	1.00	2.00	76
Age	34.01	30.50	12.68	18.00	64.00	76
Income	2.88	3.00	1.18	1.00	6.00	76
Education	3.60	4.00	1.23	1.00	6.00	75

Gender is coded as 1 = male and 2 = female. VF_Exp refers to participants' value function exponent parameter and SymMap refers to participants' symbolic-number-mapping scores.

Table S3. Summary statistics for the variables used in Study 1a

	Mean	Median	STDev	Minimum	Maximum	n
VF_Exp	0.81	0.84	0.29	-0.08	1.40	81
SymMap	-3.66	-3.46	0.94	-6.17	-2.05	81
Numeracy	4.26	4.00	1.99	0.00	8.00	81
Gender	1.51	2.00	0.50	1.00	2.00	81
Age	35.69	31.00	13.21	18.00	71.00	81
Income	2.53	2.00	1.14	1.00	5.00	81
Education	3.63	3.50	1.32	1.00	6.00	80

Gender is coded as 1 = male and 2 = female. VF_Exp refers to participants' value function exponent parameter and SymMap refers to participants' symbolic-number-mapping scores.

Table S4. Summary statistics for the variables used in Study 2

	Mean	Median	STDev	Minimum	Maximum	n
VF_Exp	0.69	0.67	0.17	0.33	1.06	99
SymMap	-3.41	-3.29	0.71	-5.64	-2.24	99
Numeracy	4.94	5.00	1.73	0.00	8.00	99
Gender	1.43	1.00	0.50	1.00	2.00	98
Age	33.85	30.00	11.94	18.00	67.00	99
Income	2.94	3.00	1.29	1.00	6.00	98
Education	3.57	3.00	1.21	1.00	6.00	99

Gender is coded as 1 = male and 2 = female. VF_Exp refers to participants' value function exponent parameter and SymMap refers to participants' symbolic-number-mapping scores.

5. Additional References

Fox, C. R., & Poldrack, R. A. (2009). Prospect theory and the brain. In P. Glimcher, E. Fehr, C. Camerer, & R. Poldrack (Eds.), *Neuroeconomics: Decision making and the brain* (145-173). London, UK: Academic Press.

Hsee, C. K., & Rottenstreich, Y. (2004). Music, pandas, and muggers: On the affective psychology of value. *Journal of Experimental Psychology: General*, *133*(1), 23.