The best-known economic theory of departures from risk-neutrality (dating to Bernoulli) attributes these to maximization of the expected value of a nonlinear function of wealth, rather than wealth itself. Prospect theory offers a descriptive account of modal behavior inconsistent with expected utility maximization by positing that decisions are based on nonlinear distortions of both the gains or losses and their probabilities, but provides no explanation for why the brain should use distorted values. Both theories imply that choice should be a deterministic function of the payoffs and probabilities, whereas in experiments it is stochastic. An alternative account is proposed, in which both stochastic choice and departures from risk-neutrality are attributed to the same cause, paralleling an explanation that has been offered for both stochasticity and bias in perceptual judgments. According to this view, both the randomness of choices and the average bias result from the fact that choices must be based on a noisy subjective representation of the decision situation, rather than on an exact description of it. Noise in the coding of the data that define the problem results in stochastic choice (conditional on the true situation), and an optimal decision rule (from the standpoint of expected wealth maximization) implies behavior that (from the standpoint of an experimenter who knows the true data) appears to violate risk-neutrality.

Our experiments document both randomness in subjects’ choices when presented repeatedly with the same risky prospects, and the “fourfold pattern of risk aversion” reported by Tversky and Kahneman. A computational model with only three free parameters (indicating the degree of noise in the subjective representations of risky monetary payoffs, certain monetary payoffs, and probabilities, respectively) suffices to allow joint prediction of several hundred moments of the experimental data, characterizing both the average biases in choice in different cases and the degree of variability in choices across trials. It thus provides a functional explanation for several of the main non-normative aspects of behavior summarized by prospect theory, linking them to the need to economize on the neural resources used to represent numerical magnitudes when evaluating risky prospects. The theory also predicts new phenomena (notably, magnitude-dependence of apparent distortion of probabilities) not predicted by prospect theory, but confirmed in our experimental data.

*Based on joint work in progress with Mel Win Khaw and Ziang Li.