DESIGNING ARBITRATION: BIOLOGICAL SUBSTRATES AND ASYMMETRY IN RISK AND REWARD

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What constitutes a rational decision? Much of our thinking about rational decision-making depends on traditional economic theories of maximized expected value. While these theories have demonstrated normative, and even prescriptive, value in general microeconomic contexts, they have spectacularly failed descriptively; they do a poor job of explaining how we make everyday decisions. Relatively new multidisciplinary efforts at the intersection of biology, behavioral economics, and evolutionary psychology have suggested predictable deviations from the standards of rational expectations based on decision rules that may have been adaptive, in the sense of conferring fitness advantages, in the environmental context in which our cognitive capacities evolved. While this predictability may offer hope of a descriptively accurate and prescriptively useful framework for examining human decision-making, we argue that the human brain, rather than being a single decision-making device, is a collection of such devices, each with different operating characteristics, and each highly domain specific, in the sense that their influence depends on adaptively relevant features of the current environment. Specifically, regarding decision-making about agreements to arbitration, it is easy to imagine many such domain specific devices that may influence expected value and related preferences. Here, we concentrate on loss aversion and risk aversion, providing evidence that these mechanisms have separate biological substrates, and demonstrating that in plausible contexts of arbitration agreement decision-making, they may operate counter to one another. Divergent influence, along with domain specificity, produces an arbitration agreement decision-making system so complex as to challenge the prescriptive utility of behavioral theories, at least at current levels of scientific rigor.

I.   INTRODUCTION

Traditional models of rational decision-making are cast as choices among risky alternatives and assume that judgments regarding odds are Bayesian[1] in nature and maximizing in expected utility.[2] Becker's account of these principles is representative: All human behavior can be viewed as involving participants who (1) maximize their utility (2)

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[1] *Contra* Gregory Todd Jones & Douglas H. Yarn, *Evaluative Dispute Resolution Under Uncertainty: An Empirical Look at Bayes' Theorem and the Expected Value of Perfect Information*, 2003 J. DISP. RESOL. 427, 440 (2003).

[2] *See* JOHN VON NEUMANN & OSCAR MORGENSTERN, THEORY OF GAMES AND ECONOMIC BEHAVIOR (1944); Daniel Kahneman & Dan Lovallo, *Timid Choices and Bold Forecasts: A Cognitive Perspective on Risk Taking*, 39 MGMT. SCI. 17 (1993); James G. March & Zur Shapira, *Managerial Perspectives on Risk and Risk Taking*, 33 MGMT. SCI. 1404, 1404-05 (1987).

from a stable set of preferences and (3) accumulate an optimal amount of information and other inputs in a variety of markets.[3]

Economists acknowledge that these principles are normative – that they suggest an approach to decision-making that is not necessarily employed by real people, but instead by a super-human rational man, *homo economicus*.[4] Even so, the influence of what is known as the "rational expectations theory"[5] has been far reaching, exerting influence in many disciplines beyond economics, including psychology,[6] political science,[7] and virtually all of the other social sciences.[8] This normative framework has been extensively applied to negotiation and conflict resolution.[9] In these contexts, parties are understood to arrive at the negotiating table with a stable set of preferences (desired outcomes to be derived from the attempt at conflict resolution), with complete information (a complete understanding of all available alternatives and their consequences in terms of specific preferences), and with the cognitive ability to maximize their utility (to decide upon an outcome that maximizes overall benefit[10] based upon an appropriate weighting of each preference for each alternative).

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[3] GARY S. BECKER, THE ECONOMIC APPROACH TO HUMAN BEHAVIOR 14 (1976).

[4] The term "economic man" was first used in criticism directed at John Stuart Mill's individualistic view of political economy characterized by the following passage:

> [Political economy] does not treat the whole of man's nature as modified by the social state, nor of the whole conduct of man in society. It is concerned with him solely as a being who desires to possess wealth, and who is capable of judging the comparative efficacy of means for obtaining that end.

John Stuart Mill, *On the Definition of Political Economy, and on the Method of Philosophical Investigation in that Science*, 4 LONDON & WESTMINSTER REV. 12 (1836). *See also* Joseph Persky, *Retrospectives: The Ethology of Homo Economicus*, 9 J. ECON. PERSP. 221-22 (1995).

[5] *See* LEONARD J. SAVAGE, THE FOUNDATIONS OF STATISTICS (1954) (noting that the foundations of statistics are connected conceptually with many disciplines outside of statistics itself).

[6] *See* Herbert A. Simon, *Rationality as Process and as Product of Thought*, AM. ECON. REV. 1, 2-3(1978); Herbert A. Simon, *Rationality in Psychology and Economics*, U. CHI. PRESS (1986), *reprinted in* RATIONAL CHOICE: THE CONTRAST BETWEEN ECONOMICS AND PSYCHOLOGY 25 (Robin M. Hogarth & Melvin W. Reder eds., 1987).

[7] *See* DONALD P. GREEN & IAN SHAPIRO, PATHOLOGIES OF RATIONAL CHOICE THEORY, at x (1994) (seeking to initiate a conversation between rational choice theorists and other students of politics).

[8] *See* ROBIN M. HOGARTH & MELVIN W. REDER, *Introduction: Perspectives from Economics and Psychology in* RATIONAL CHOICE: THE CONTRAST BETWEEN ECONOMICS AND PSYCHOLOGY 1 (Robin M. Hogarth & Melvin W. Reder eds., 1987).

[9] STEVEN J. BRAMS, NEGOTIATION GAMES (1990) (seeking to "synthesize and interpret theoretical results in . . . negotiation literature"); DAVID A. LAX & JAMES K. SEBENIUS, THE MANAGER AS NEGOTIATOR (1986) (providing a development of negotiation analysis and an approach to the manager's job); HOWARD RAIFFA, THE ART AND SCIENCE OF NEGOTIATION (1982) (blending discussion of the practical side of negotiating with simple mathematical analysis); HOWARD RAIFFA, LECTURES ON NEGOTIATION ANALYSIS (1996) (the Program on Negotiation at Harvard Law School); HOWARD RAIFFA, NEGOTIATION ANALYSIS (2002) (focusing on analysis *for* negotiations as opposed to analysis *of* negotiations). Indeed, the application to negotiation and conflict resolution settings culminated in the unequivocal handbook of the field, *Getting to Yes*, which has sold more than two million copies in 20 different languages. ROGER FISHER, WILLIAM URY & BRUCE PATTON, GETTING TO YES: NEGOTIATING AN AGREEMENT WITHOUT GIVING IN (rev. 2d ed. 2003).

[10] Contrary to the simple message of *Getting to Yes*, one should keep in mind that the maximizing outcome may be to walk away from the negotiations. "*Negotiating rationally* means making the best decisions to *maximize* your interests. However, we are not concerned with 'getting to yes.' Our work shows that in many cases, no agreement at all is better than 'getting to yes.'" MAX H. BAZERMAN & MARGARET A. NEALE, NEGOTIATING RATIONALLY 1 (1992).

Unfortunately, while rational expectations theories have demonstrated normative and even prescriptive value in general microeconomic contexts, they have spectacularly failed descriptively; they do a poor job of explaining how we make everyday decisions. Indeed, this traditional version of rationality is unable to answer simple questions about common human experience, such as why we frequently act to benefit others at a cost to ourselves. As early as 1954, Meehl published evidence of a divergence between decision-making models based on simple linear combinations, and therefore consistent with the fundamental tenets of rational expectation, and descriptive models of actual decision-making behavior.[11] As Simon later put it,

> [t]he rational person of neoclassical economics always reaches the decision that is objectively, or substantively, best in terms of the given utility function. The rational person of cognitive psychology goes about making his or her decisions in a way that is procedurally reasonable in light of the available knowledge and means of computation.[12]

These distinctions led to a natural shift in emphasis described by Kahneman, Slovic, and Tversky in the introduction to their groundbreaking text, *Judgment under Uncertainty: Heuristics and Biases*: "The matching of human judgments to normative models was to become one of the major paradigms of research on judgment under uncertainty. Inevitably, it led to concerns with the biases to which inductive inferences are prone and the methods that could be used to correct them."[13]

A number of these heuristics and biases have been shown to influence negotiation and conflict resolution efforts in ways that produce results inconsistent with the predictions of normatively rational models.[14] Studies have observed an unwillingness to recognize sunk costs and the resulting irrational escalation of commitment to positions that are no longer optimal.[15] Attitudes towards risk are often affected merely by the manner in which

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[11] *See* PAUL E. MEEHL, CLINICAL VERSUS STATISTICAL PREDICTION (1954) (There is no convincing reason to assume that explicitly formalized mathematical rules and the clinician's creativity are equally suited for any given kind of task).

[12] Herbert A. Simon, *Rationality in Psychology and Economics*, U. CHI. PRESS (1986), *reprinted in* RATIONAL CHOICE: THE CONTRAST BETWEEN ECONOMICS AND PSYCHOLOGY 25, 27 (Robin M. Hogarth & Melvin W. Reder eds., 1987).

[13] DANIEL KAHNEMAN, PAUL SLOVIC & AMOS TVERSKY, JUDGMENT UNDER UNCERTAINTY: HEURISTICS AND BIASES (Cambridge University Press, 1982).

[14] *See* MAX H. BAZERMAN, JUDGMENT IN MANAGERIAL DECISION MAKING 6 (1986); Max H. Bazerman & Margaret A. Neale, *Heuristics in Negotiation: Limitations to Dispute Resolution Effectiveness in* NEGOTIATING IN ORGANIZATIONS 51, 52 (Max H. Bazerman & Roy J. Lewicki eds., 1983); MAX H. BAZERMAN & MARGARET A. NEALE, NEGOTIATING RATIONALLY 1 (1992); MARGARET A. NEALE & MAX H. BAZERMAN, COGNITION AND RATIONALITY IN NEGOTIATION 43 (1991); H. PEYTON YOUNG, NEGOTIATION ANALYSIS 2 (1991). For excellent reviews of the intellectual foundations of these works, *see* DANIEL KAHNEMAN, PAUL SLOVIC, AMOS TVERSKY, JUDGMENT UNDER UNCERTAINTY: HEURISTICS AND BIASES (1982); DANIEL KAHNEMAN & AMOS TVERSKY, CHOICES, VALUES, AND FRAMES (2000); SCOTT PLOUS, THE PSYCHOLOGY OF JUDGMENT AND DECISION MAKING, at xii (1993).

[15] *See, e.g.*, Gregory B. Northcraft & Margaret A. Neale, *Opportunity Costs and the Framing of Resource Allocation Decision*, 37 ORG. BEHAV. & HUM. DECISION PROCESSES, 348 (1986); Max H. Bazerman & Margaret A. Neale, *Heuristics in Negotiation: Limitations to Dispute Resolution Effectiveness in* NEGOTIATIONG IN ORGANIZATIONS 60, 60-61 (Max H. Bazerman & Roy J. Lewicki eds. 1983).

alternatives are framed as either potential gains or potential losses.[16] New information is underutilized in updating positions that are anchored by previous estimates or prior information.[17] Parties are generally overconfident with regards to their likelihood of success and to their ability to predict uncertain events.[18] Related to this overconfidence is the tendency to reactively devalue information or any concession offered by opposing parties.[19] Even information offered by third party neutrals is undervalued and underutilized.[20] In general, these biases have been viewed as pathologies in need of correction.[21] However, despite this attention, there is little consensus with regard to the promise of de-biasing.[22]

Relatively new multidisciplinary efforts at the intersection of biology, behavioral economics, and evolutionary psychology have further developed theories of rational decision-making to take into account cognitive constraints of the human mind.[23] According to this thinking, adaptive decision rules or heuristics and biases, driven by fitness advantage, may be more effective than utility maximization due to their relative computational

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[16] *See, e.g.*, Vandra L. Huber, Margaret A. Neale & Gregory B. Northcraft, *Judgment by Heuristics: Effects of Rater and Ratee Characteristics and Performance Standards on Performance-Related Judgments*, 40 ORG. BEHAV. & HUM. DECISION PROCESSES 149, 150-51 (1987); Margaret A. Neale & Max H. Bazerman, *The Effects of Framing and Negotiator Overconfidence on Bargainer Behavior*, 28 ACADEMY OF MGMT. J. 34, 35-36 (1985); Amos Tversky & Daniel Kahneman, *Judgment Under Uncertainty: Heuristics and Biase*s, 185 SCI. 1124, 1128 (1974).

[17] *See, e.g.,* Tversky & Kahneman, *supra* note 16; Vandra L. Huber & Margaret A. Neale, *Effects of Cognitive Heuristics and Goals on Negotiator Performance and Subsequent Goal Setting*, 38 ORG. BEHAV. & HUM. DECISION PROCESSES 342, 345 (1986); Gregory B. Northcraft & Margaret A. Neale, *Experts, Amateurs, and Real Estate: An Anchoring-and-Adjustment Perspective on Property Pricing Decisions*, 39 ORG. BEHAV. & HUM. DECISION PROCESSES 84, 85 (1987).

[18] *See, e.g.*, Margaret A. Neale & Max H. Bazerman, *The Effects of Framing and Negotiator Overconfidence on Bargainer Behavior*, 28 ACAD. MGMT. J. 34, 37-35 (1985); Max H. Bazerman & Margaret A. Neale, *Improving Negotiation Effectiveness Under Final Offer Arbitration: The Role of Selection and Training*, 67 J. APPLIED PSYCHOL. 543, 544 (1982).

[19] *See, e.g.* Lee Ross, *Reactive Devaluation in Negotiation and Conflict Resolution in* BARRIERS TO CONFLICT RESOLUTION 26 (Kenneth Arrow, et al. eds., 1995).

[20] *See, e.g.*, Gregory Todd Jones & Douglas H. Yarn, *Evaluative Dispute Resolution Under Uncertainty: An Empirical Look at Bayes' Theorem and the Expected Value of Perfect Information*, J. DISP. RESOL. 427, 457 (2003).

[21] *See, e.g.*, DONALD GREEN & IAN SHAPIRO, PATHOLOGIES OF RATIONAL CHOICE THEORY (1994). For thinking on de-biasing, *see generally* Asher Koriat, Sarah Lichtenstein & Baruch Fischhoff, *Reasons for Confidence*, 6 J. EXPER. PSYCHOL. HUM. LEARNING & MEMORY 107 (1980); Sarah Lichenstein, Baruch Fischhoff & Lawrence D. Phillips, *Calibration of Probabilities: The State of the Art to 1980 in* JUDGMENT UNDER UNCERTAINTY: HEURISTICS AND BIASES 306-34 (Daniel Kahneman, Paul Slovic & Amos Tversky eds., 1982); Robin M. Dawes, *The Robust Beauty of Improper Linear Models in Decision Making*, 34 AM. PSYCHOL. 571-82 (1979); Baruch Fishhoff, *Debiasing, in* JUDGMENT UNDER UNCERTAINTY: HEURISTICS AND BIASES (Daniel Kahneman, Paul Slovic & Amos Tversky eds., 1982); Richard E. Nisbett, et al., *Improving Inductive Inference in* JUDGMENT UNDER UNCERTAINTY: HEURISTICS AND BIASES (Daniel Kahneman, Paul Slovic & Amos Tversky eds., 1982). *See also* MAX H. BAZERMAN, JUDGMENT IN MANAGERIAL DECISION MAKING 6 (2002); *See generally* JOHN ALLEN PAULOS, INNUMERACY: MATHEMATICAL ILLITERACY AND ITS CONSEQUENCES (2001) (for dealing with non-probabilistic thinking).

[22] Amos Tversky & Daniel Kahneman, *Rational Choice and the Framing of Decisions*, 59 J. BUS. S251-78 (Oct. 1986), *reprinted in* RATIONAL CHOICE: THE CONTRAST BETWEEN ECONOMICS AND PSYCHOLOGY 67, 68 (Robin M. Hogarth & Melvin W. Reder eds., 1987).

[23] *See* GERD GIGERENZER & REINHARD SELTEN, BOUNDED RATIONALITY 1 (2002).

simplicity in a context of cognitive limitation.[24] In this sense, utility can be thought of in terms of fitness, where fitness is the ability to pass along genes into the next generation.[25]

In what follows, we adopt this evolutionary approach of equating utility with fitness in developing a behavioral version of rationality with two specific postulates. First, that the human brain, rather than being a single decision-making device, is a collection of such devices, each with different operating characteristics.[26] Second, that these devices are highly domain specific, in the sense that their relative influence depends on adaptively relevant features of the current environment.[27] The central question is whether such a behavioral understanding can provide insight into actual experience with the negotiation of arbitration agreements, and further, whether this understanding can help us to design this process in a manner that would produce improved societal outcomes. We concentrate attention on loss aversion and risk aversion, showing that while related, these systems have distinct biological substrates, and that their relative influence depends on a domain specificity that produces different behaviors in different contexts.[28] Next, we demonstrate that in plausible contexts of arbitration agreement decision-making, these systems may operate counter to one another. Finally, we conclude that this divergent influence, along with the domain specificity in extremely complex social environments, limits the prescriptive utility of behavioral theories in increasing understanding of arbitration agreement decision-making systems, at least given the current scientific capabilities for isolating the influence of specific cognitive devices.

II.   LOSS AVERSION

Many everyday decision-making contexts involve the possibility of either gaining or losing relative to the status quo. In these instances, human decision-makers tend to demonstrate a significant aversion to loss. In fact, prospect theory,[29] the most successful behavioral theory of decision-making under uncertainty, has demonstrated that the

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[24] GERD GIGERENZER, PETER M. TODD & THE ABC RESEARCH GROUP, SIMPLE HEURISTICS THAT MAKE US SMART, at vii (1999); HERBERT SIMON, *A Behavioral Model of Rational Choice in* MODELS OF MAN, SOCIAL AND RATIONAL 241 (1957).

[25] ARTHUR E. GANDOLFI, ANNA SACHKO GANDOLFI & DAVID BARASH, ECONOMICS AS AN EVOLUTIONARY SCIENCE: FROM UTILITY TO FITNESS, at xii (2002).

[26] H. Clark Barrett & Robert Kurzban, *Modularity in Cognition: Framing the Debate*, 113 PSYCHOL. REV. 628, 629 (2006); Douglas T. Kenrick, Edward K. Sadalla & Richard C. Keefe, *Evolutionary Cognitive Psychology: The Missing Heart of Modern Cognitive Science in* HANDBOOK OF EVOLUTIONARY PSYCHOLOGY: IDEAS, ISSUES, AND APPLICATIONS 485, 490-91 (Charles B. Crawford & Dennis L. Krebs eds., 1998).

[27] Douglas T. Kenrick, Norman P. Li & Jonathan Butner, *Dynamical Evolutionary Psychology: Individual Decision Rules and Emergent Social Norms*, 110 PSYCHOL. REV. 3-38 (2003); Mark Schaller, Justin H. Park & Douglas T. Kenrick, *Human Evolution and Social Cognition in* THE OXFORD HANDBOOK OF EVOLUTIONARY PSYCHOLOGY 491 (Robin Dunbar & Louise Barrett eds., 2007).

[28] Joshua M. Ackerman, Douglas T. Kenrick & Mark Schaller, *Is Friendship Akin to Kinship?*, 28 EVOLUTION & HUM. BEHAV. 365-72 (2007); Alan P. Fiske, *The Four Elementary Forms of Sociality: Framework for a Unified Theory of Social Relations*, 99 PSYCHOL. REV. 689-90 (1992); Douglas T. Kenrick, Jill M. Sundie & Robert Kurzban, *Cooperation and Conflict Between Kith, Kin, and Strangers: Game Theory by Domains in* FOUNDATIONS OF EVOLUTIONARY PSYCHOLOGY 351, 354 (Charles Crawford & Dennis Krebs eds., 2008).

[29] Daniel Kahneman & Amos Tversky, *Prospect Theory: An Analysis of Decision Under Risk*, 47 ECONOMETRICA 263 (1979); *see also* Nathan Novemsky & Daniel Kahneman, *How Do Intentions Affect Loss Aversion?*, 42 J. MARKET RES. 139 (2005); Colin Camerer, *Three Cheers – Psychological, Theoretical, Empirical – for Loss Aversion*, 42 J. MARKETING RES. 129 (2005); Ulrich Schmidt & Horst Zank, *What is Loss Aversion?*, 30 J. RISK & UNCERTAINTY 157 (2005).

subjective impact of losses is roughly twice that of gains.[30] That is, we typically demand a potential gain of $100 or more in order to accept the risk of a loss of $50 in a 50/50 gamble. *See* Figure One below. Loss aversion has been employed to explain the framing effect, where decision-makers tend to be more risk-averse when options are framed as gains than when probabilistically equivalent options are framed as losses,[31] and the endowment effect, where decision-makers demand more to give up a possession than they would have been willing to pay in order to obtain the same item.[32] Loss Aversion is also seen in a wide variety of ecological settings,[33] including economic exchange in young children[34] and non-human primates,[35] suggesting that "it may reflect a fundamental feature of how potential outcomes are assessed by the primate brain."[36]

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[30] Sabrina M. Tom et al., *The Neural Basis of Loss Aversion in Decision-Making Under Risk*, 315 SCIENCE 515, 515 (2007).

[31] Amos Tversky & Daniel Kahneman, *The Framing of Decisions and the Psychology of Choice*, 211 SCIENCE 453, 453 (1981). *See also* SCOTT PLOUS, THE PSYCHOLOGY OF JUDGMENT AND DECISION MAKING 134-35 (1993).

     The classic set of experiments on framing performed by Amos Tversky and Daniel Kahneman demonstrated that simply using different language to present probabilistically equivalent choices effected subject's choices of disease prevention strategies. First, subjects were asked to choose between two strategies for 600 people affected by a deadly disease:

        A: saves 200 people.

        B: 33% chance of saving all 600 people and 66% possibility of saving no one.

     While these strategies, framed as gains, have the same expected value of 200 lives saved, 72% of subjects chose option A, while 28% of subjects chose option B. In the second scenario, subjects were asked to choose between two slightly differently worded strategies:

        C: 400 people die.

        D: 33% chance that no people will die and a 66% possibility that all 600 will die.

     These strategies, framed as losses, have the same expected value of 200 lives saved but produced very different results. Here, 78% of subjects chose option D (which is equivalent to option B), and 22% of subjects chose option C (which is equivalent to option A).

Tversky & Kahneman, *supra* at 453.

[32] Jason F. Shogren et al., *Resolving Differences in Willingness to Pay and Willingness to Accept*, 84 AMER. ECON. REV. 255, 264 (1994); *see also* W. Michael Hanemann, *Willingness to Pay and Willingness to Accept: How Much Can They Differ?*, 81 AM. ECON. REV. 635 (1991) (offering an explanation for large disparities between what a consumer is willing to pay for a public good and what he is willing to accept for the same good); *see generally* Richard Thaler, *Toward a Positive Theory of Consumer Choice*, 1 J. ECON. BEHAV. & ORG. 39 (1980) (providing evidence in support of the endowment effect hypothesis).

[33] Shlomo Benartzi & Richard H. Thaler, *Myopic Loss Aversion and the Equity Premium Puzzle*, 110 Q. J. ECON. 73 (1995).

[34] *See generally* William T. Harbaugh et al., *Are Adults Better Behaved Than Children? Age, Experience, and the Endowment Effect*, 70 ECON. LETTERS 175 (2001) (finding no evidence that the endowment effect decreases with age).

[35] *See* M. Keith Chen et al., *The Evolution of Our Preferences: Evidence from Capuchin Monkey Trading Behavior*, 114 J. POL. ECON. 517 (2006) (finding loss aversion characteristics in capuchin monkeys faced with gambles); *see also* Sarah F. Brosnan et al., *Endowment Effects in Chimpanzees*, 17 CURRENT BIOLOGY 1704 (2007); *cf.* Owen D. Jones & Sarah F. Brosnan, *Law, Biology, and Property: A New Theory of the Endowment Effect*, 49 WM. & MARY L. REV. 1935 (2008).

[36] Tom et al., *supra* note 30, at 515.
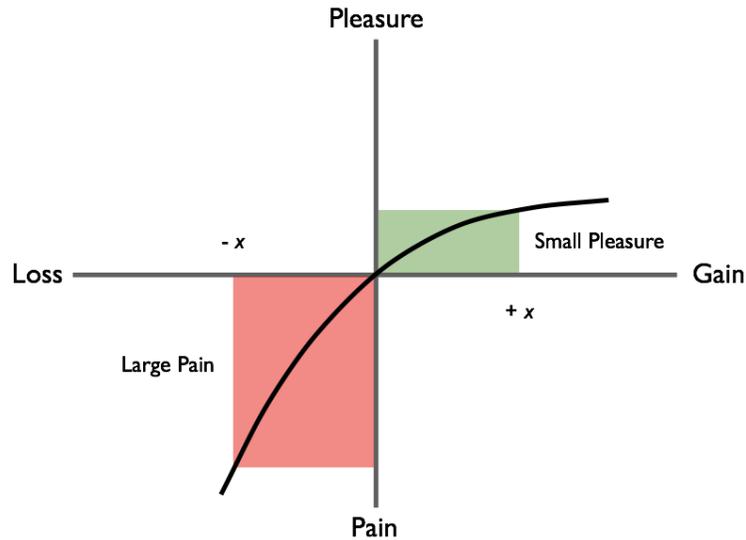
Figure One

Asymmetric Curvilinear Utility Leading to a Preference for Mitigating Losses Over Acquiring Gains
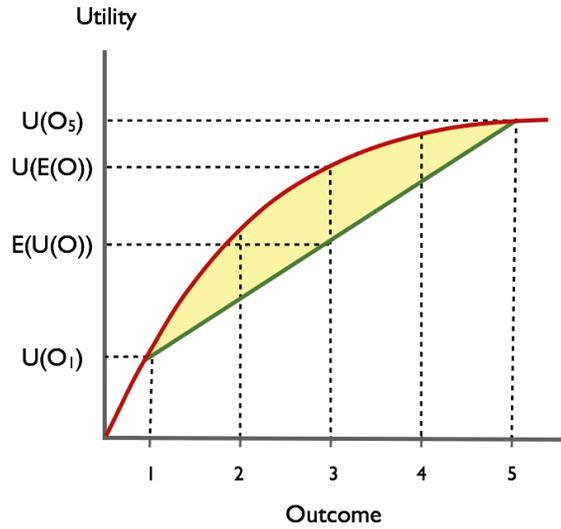
III.   RISK AVERSION

Decision-makers also tend to favor certain outcomes over relatively uncertain outcomes, even when a certain outcome offers a lower expected payoff.[37]   Referring to Figure Two, a risk-averse decision-maker would prefer a certain outcome of 3 (U(E(O))), to a fifty-fifty gamble for an outcome of 1 or 5 (E(U(O))), even though the expected value of such a gamble ((.5 x 1) + (.5 x 5)) in fact equals 3. The certain outcome of three offers an utility increase of U(E(O)) – E(U(O)) due to risk aversion. Similarly, while a fifty-fifty gamble for an outcome of 2 or 4 is equivalent in expected value terms to a fifty-fifty gamble for an outcome of 1 or 5, the gamble for 1 or 5 poses more risk. Therefore, the gamble for 2 or 4 offers more utility for risk-averse decision-makers. *See* Figure Three below. Like loss aversion, risk aversion has been widely demonstrated in human[38] and non-human primates,[39] suggesting, again, a mechanism with an evolutionary explanation.[40]

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[37] *See* Kenneth J. Arrow, ESSAYS IN THE THEORY OF RISK-BEARING 90-120 (Julius Margolis ed., 1971); *see also* John W. Pratt, *Risk Aversion in the Small and in the Large*, 32 ECONOMETRICA 122 (1964).

[38] Joshua W. Brown & Todd S. Braver, *Risk Prediction and Aversion by Anterior Cingulate Cortex*, 7 COGNITIVE AFFECTIVE & BEHAV. NEUROSCIENCE 266, 267 (2007); *see also* Ulrich Schmidt & Horst Zank, *Risk Aversion in Cumulative Prospect Theory*, 54 MGMT. SCI. 208 (2008).

[39] *See generally* Charles H. Jansen & Carel P. van Schaik, *Ecological Risk Aversion in Juvenile Primates: Slow and Steady Wins the Race in* JUVENILE PRIMATES: LIFE HISTORY, DEVELOPMENT AND BEHAVIOR 57 (Michael E. Pereira & Lynn A. Fairbanks eds., 2002) (demonstrating risk-averse ecological policies adopted by juvenile primates).

[40] Paul H. Rubin & Chris W. Paul, II, *An Evolutionary Model of Taste for Risk*, 17 ECON. INQUIRY 585 (1979).

Figure Two

Risk Aversion Leads to a Preference for a Certain Outcome of 3 (U(E(O))) Over the Expected Value Equivalent Fifty-Fifty Gamble for an Outcome of 1 or 5 (E(U(O)))
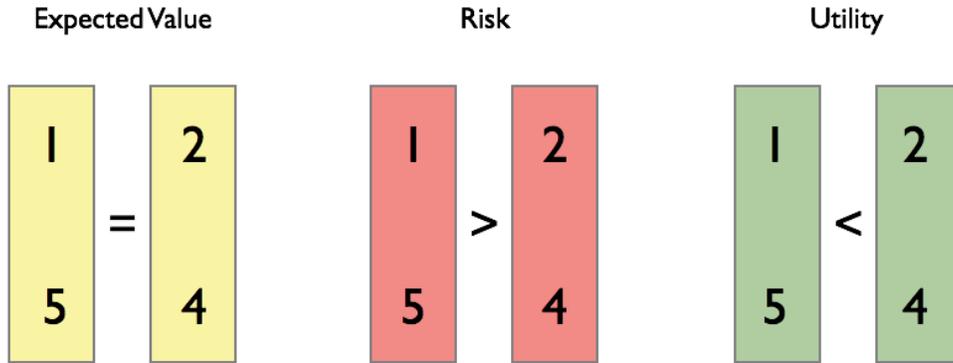
Figure Three

While a Fifty-Fifty Gamble for an Outcome of 1 or 5 is Expected Value Equivalent to a Fifty-Fifty Gamble for an Outcome of 2 or 4, the Gamble for 1 or 5 Poses More Risk and the Gamble for 2 or 4 Offers More Utility

IV.   DIVERGENT INFLUENCE, DOMAIN SPECIFICITY & COMPLEXITY

Loss aversion and risk aversion are related. Both owe their effect to a utility function that is concave over wealth. Indeed, these systems may share the same ultimate, or evolutionary, causation. As our cognitive capacities evolved, life was not characterized by safety nets. Our ancestors lived close to the margin. The spoils of hunting could not be put

into a bank. So a gain beyond satiation offered little utility, while a loss might literally mean death and the resulting inability to pass on your risk-seeking genes to the next generation.

Yet, the human brain is not a monolithic decision-making unit. Rather, it is a system of decision-making units, each with different operating characteristics.[41] There is increasing evidence that the cognitive source, or proximate cause, of loss aversion, vis-à-vis risk aversion, is different. Loss aversion emanates from the amygdala,[42] along the mesolimbic dopaminergic pathway, and produces a low road, emotional reaction to the prospect of a loss.[43] Risk aversion, on the other hand, emanates from the anterior cingulate cortex,[44] which seems to serve as a bridge from the emotional amygdala to the cognitive prefrontal cortex.[45] It is likely implicated in the more evolutionarily recent need to calculate and compare expected utilities of decision alternatives. This integration may properly be thought of as distributed processing, with the subcortical regions driving affective components and the cortical regions driving probabilistic components.[46] Loss aversion and risk aversion, therefore, have separate biological substrates. Further, in plausible contexts of arbitration agreement decision-making, the mechanisms may operate counter to one another. In many cases, arbitration agreements limit the size of awards, restricting indirect, punitive, and other damages normally allowed by law.[47] Owing to loss aversion, the presence of an arbitration agreement would produce a relatively small reduction in utility for plaintiffs as compared to a large increase in utility for defendants.[48] *See* Figure Four.

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[41] Douglas T. Kenrick et al., *Deep Rationality: The Evolutionary Economics of Decision Making*, 27 SOC. COGNITION 764, 765 (2009) [hereinafter Kenrick, *Deep Rationality*].

[42] *See* Benedetto De Martino et al., *Amygdala Damage Eliminates Monetary Loss Aversion*, 107 PROC. NAT'L ACAD. SCI. 3788 (2010).

[43] *Cf.* Luiz Pessoa, *Emotion and Cognition and the Amygdala: From "What is it?" to "What's to be Done?"*, 48 NEUROPSYCHOLOGIA 3416 (2010).

[44] *See* Brown & Braver, *supra* note 38, at 267; George I. Christopoulos et al., *Neural Correlates of Value, Risk and Risk Aversion Contributing to Decision Making Under Risk*, 29 J. NEUROSCIENCE 12574 (2009).

[45] *See generally* Alexander J. McDonald, *Cortical Pathways to the Mammalian Amygdala*, 55 PROGRESS NEUROBIOLOGY 257 (1998) (analyzing how sensory information is transmitted from the prefrontal cortex to the amygdala through critical pathways in the rat, cat, and monkey).

[46] Brian Knutson et al., *Distributed Neural Representation of Expected Value*, 25 J. NEUROSCIENCE 4806, 4806 (2005); *see generally* Alan G. Sanfey et al., *The Neural Basis of Economic Decision-Making in the Ultimatum Game*, 300 SCI. 1755 (2003) (demonstrating the role of both emotion (anterior insula) and cognition (dorsolateral prefrontal cortex) in risky decision making); *see generally* Daria Knoch et al., *Disruption of Right Prefrontal Cortex by Low-Frequency Repetitive Transcranial Magnetic Stimulation Induces Risk-Taking Behavior*, 26 J. NEUROSCIENCE 6469 (2006) (providing evidence of increasing risk tolerance with disruption of the right prefrontal cortex).

[47] *See* Thomas J. Stipanowich, *Punitive Damages and the Consumerization of Arbitration*, 92 NW. U. L. REV. 1, 22-23 (1997).

[48] Note that these circumstances raise the possibility that side payments, in this case from the defendant to the plaintiff, could motivate an arbitration agreement producing a Pareto improvement.
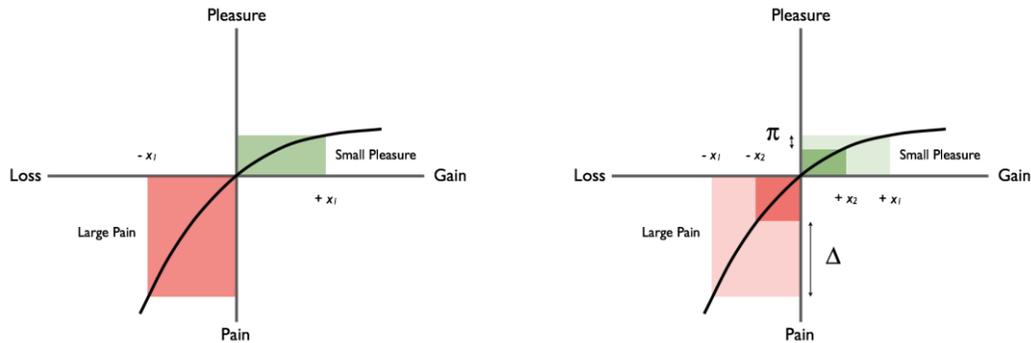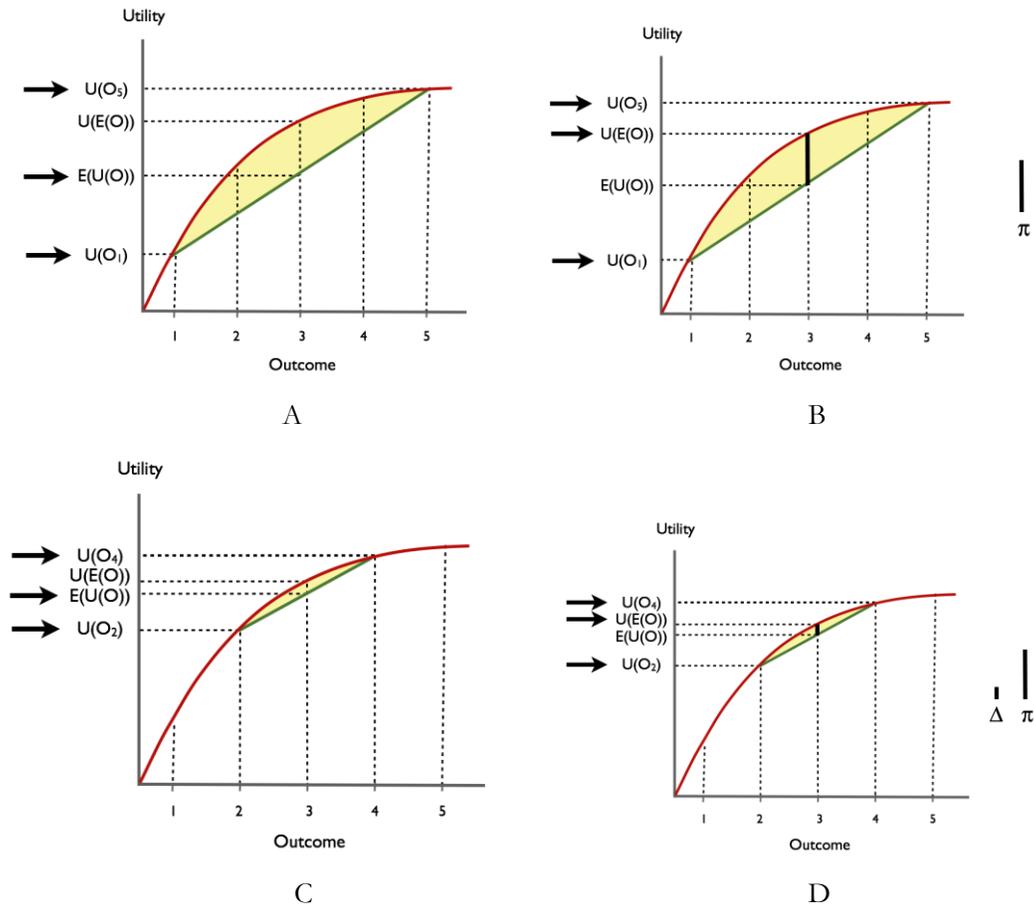
Figure Four

Arbitration Agreements, Assuming Loss Aversion, Produce Larger Increases in Utility for Defendants (Δ) than Decreases for Plaintiffs (Π).

       Arbitrators often have process expertise and subject matter expertise along with an incentive to render reasonable, carefully thought out decisions. These factors have the tendency to reduce variability in outcomes. For plaintiffs, for example, referring to Figure Five, converting a relatively uncertain outcome in the form of a fifty-fifty gamble between \$1 and \$5 (think litigation) to a relatively certain outcome, say, for a certain \$3, would, according to expected value theory, produce a utility in the middle, at $E(U(O))$ in panel B. Instead, this reduction in risk produces a higher utility for risk-averse decision-makers, at $U(E(O))$ in panel B, giving the plaintiff a significant marginal benefit (Π).

       Things are different for defendants. In a domain where, as we will assume for the moment, defendants manage portfolios of litigation risk, engaging in risk management activities offers to mitigate overall risk, with an outcome of the defendant viewing all *individual* claims as less risky.[49] As a result, the defendant's utility of the relatively certain outcome, $U(E(O))$ in panel D, exceeds the expected utility, $E(U(O))$ in panel D, by a relatively small marginal benefit (Δ). Thus, loss aversion, in the context of restricted arbitral awards, produces a larger incentive for defendants, as compared to plaintiffs, to enter into arbitration agreements. Risk aversion, however, produces larger incentives for relatively inexperienced plaintiffs to enter into arbitration agreements, when compared to defendants who manage portfolios of litigation risk. Which incentive exerts a stronger influence? The subjective nature of these mechanisms[50] makes this a very difficult question to answer.

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[49] *See* Nicholas Barberis & Ming Huang, *Mental Accounting, Loss Aversion, and Individual Stock Returns*, 56 J. FIN. 1247, 1249 (2001).

[50] *See generally* Kenrick, *Deep Rationality*, *supra* note 41, at 774 (suggesting that loss aversion can be defined by variously shaped utility curves and risk aversion can be defined by various magnitudes of risk aversion, risk neutrality, or even risk taking determined by numerous factors including gender, stage in life, and overall resource availability).

Figure Five

Arbitration Agreements, Assuming Risk Aversion, Produce Larger Increases in Utility for Plaintiffs (Π) than Increases for Defendants (Δ)

V.   CONCLUSIONS

Significant evidence is emerging of a neural basis for social cooperation and conflict resolution.[51]   However, this basis emerges not from a monolithic neural decision-making unit, but from a system of decision-making mechanisms, each with unique, and highly domain dependent, operating characteristics. These mechanisms, as we have demonstrated in the case of loss aversion and risk aversion, may, in plausible contexts, operate contrary to one another. This divergent influence, along with domain specificity, produces an arbitration agreement decision-making system so complex as to challenge the prescriptive utility of behavioral theories, at least at current levels of scientific rigor.[52]

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[51] *See* James K. Rilling et al., *A Neural Basis for Social Cooperation*, 35 NEURON 395 (2002).

[52] Our thought experiment offered here is grossly oversimplified. For example, while we have learned a fair amount about risk aversion, we know little about ambiguity aversion, which would also certainly be influenced by the presence or absence of an arbitration agreement as well as the process of arbitration. *See* Scott A. Huettel et

Further, decision-makers cannot evaluate and manage, or override, the influence of these mechanisms, even if we could offer an optimizing prescription. Indeed, the activation of these mechanisms does not merely "correlate with expectations, but also precedes and may promote decisions."[53] For this reason, we wrestle with whether, from a public policy standpoint, this evolutionary, fitness-based utility is what we should be seeking to optimize. However, we can't lose sight of the fact that we are engaged in the design of abstract institutions, and the objective has to be the production of trust that will encourage engagement in abstract relationships. The production of trust requires recognition of reward centers in our brains that are tens of thousands of years old.

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al., *Neural Signatures of Economic Preferences for Risk and Ambiguity*, 49 NEURON 765 (2006); *see also* Ming Hsu et al., *Neural Systems Responding to Degrees of Uncertainty in Human Decision-Making*, 310 SCI. 1680 (2005) (providing an explanation of increased complication when considering ambiguity aversion, which would also be influenced by the presence or absence of an arbitration agreement and the process of arbitration).

[53] Brian Knutson & Peter Bossaerts, *Neural Antecedents of Financial Decisions*, 27 J. NEUROSCIENCE 8174, 8176 (2007).