Introduction

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Despite considerable advances in the area of "Psychology and Economics" in recent years, the discipline is still in its infancy. Psychologists have a long tradition of studying human behavior, strengths and weaknesses, biases and limitations. Economists have constructed normative frameworks that capture the most important elements of human decision-making and developed powerful tools to determine individual and strategic choices in a variety of situations. Only recently strengths have been combined and economic models enriched with key ingredients found in psychological studies. The exercise has a tremendous potential. However, it is easy to realize the difficulties faced by researchers in their attempt to add complexity to the human mind without sacrificing tractability of the models. This volume covers four of the most important themes in this interdisciplinary field: Feelings, inconsistencies, limitations, and biases. We view each chapter as a modest step towards a more comprehensive and accurate modeling and description of human behavior. We provide below a brief summary of each contribution.

I. BELIEFS: ORIGINS, FORMATION, AND EVOLUTION

Beliefs are at the source of every decision. We can follow our beliefs or combat them. We can accept the news or instrumentally manipulate them. At one end of the spectrum is the rational *homo-economicus*, fully constrained by the available evidence and the Bayesian information processing mechanism. At the other end is the irrational individual who keeps pleasurable or undesirable, comforting or fearful beliefs, independently of the information he or she confronts. Part I studies the problem of beliefs from three different angles: The pro-motivated formation of beliefs (Chapter 1), the systematic cognitive biases in the updating of beliefs (Chapter 2), and the emotional drawbacks caused by inaccurate beliefs (Chapter 3). Other contributions in this volume also treat to some degree the effect of beliefs in decision-making: The optimality and strategic role of ignorance (Chapter 4), the persistence of initial beliefs (Chapter 8), or the subjective nature of the perceptions that form our beliefs (Chapter 9).

Chapter 1. For a long time, mental states (motivations and beliefs) have been considered exogenous variables in economic studies. This chapter starts with the following question: What explains the beliefs and motivations of the agent?

Elster claims that mental states can be motivated. Although he recognizes the existence of counter-motivated mental states, he focus on pro-motivated ones and, within this category, draws the distinction between wishful and self-deceptive belief formation and motivation.

The cornerstone of Elster's theory is the idea that motivated mental states are subject to costs and constraints. Costs are quite natural. For instance, inaccurate beliefs may be pleasant but, at the same time, induce suboptimal choices or have emotional drawbacks (see Chapter 3). As for the constraints, he distinguishes between three types. First, consistency: In the absence of new hard evidence, final judgments and beliefs are partly constrained by priors. Second, plausibility: Individuals must be able to justify their behavior with plausible and coherent stories. Third, imperfection: The motivated beliefs and motivations should partly promote self-interest. However, they should deviate from the ideal mental state, otherwise they would reveal too transparently their opportunistic nature. Looking at the literature in economics and psychology, the author concludes that while economists have concentrated their research efforts on costs and neglected constraints, psychologists have suffered from the opposite bias focusing exclusively on the constraints (Chapter 11, for example, studies the related issue of constraints in mood management). A comprehensive theory of mental state formation—argues Elster—must take into account both issues.

One should notice that, while earlier economic theories of bounded rationality were based on cost-benefit analyses, the recent research has instead been developed around the constraints on belief formation. For example, in the literature on information processing under bounded rationality, agents suffer from overconfidence, confirmatory bias, or optimism (just to name a few anomalies) but their final belief is constrained by priors and a quasi-Bayesian updating of information. In any case, we agree with the author that the next theoretical challenge is to incorporate both costs and constraints in a model of the mind.

Chapter 2. When decision-makers interpret new evidence, how accurately do they distinguish between information and noise? Is there any systematic bias in their judgment? In more technical words, are beliefs updated according to Bayes' rule? Massey and Wu provide a theory and some experimental evidence on this problem. The authors note that sometimes individuals under-react to information (i.e. they put too much weight on noise to explain outcomes) whereas some other times they over-react (i.e. they put too little weight on noise). Interestingly, these two opposite biases occur in fundamentally different contexts. More precisely, under-reaction is most common in unstable environments in which signals are precise and over-reaction is most common in stable environments in which signals are noisy. So, for example, if a machine has a high chance of breaking and rarely produces a defective piece when it is in good condition, then the owner will wait for an excessively long series of defective pieces before acknowledging a problem. Conversely, if a machine has a low chance of breaking but produces a fair amount of defective pieces when it is in good condition, then

the owner will believe that there is a problem after an excessively short series of defective pieces. Massey and Wu argue that one theory, called "system neglect," explains both biases: Individuals react excessively to signals of change (defective pieces) and insufficiently to the system that generates the signals (likelihood of breaking). This hypothesis is supported by a series of experiments in which the authors vary the informational content of signals and the stability of the system. Thus, in order to correct this judgment bias, decision-makers should decrease the attention paid to the events and increase the attention paid to the environment.

The authors' ability to propose a unified hypothesis in order to explain apparently contradictory phenomena is highly seducing. One may wonder whether there is a relation between this theory and the well-documented tendency of individuals to overestimate low-probability and underestimate high-probability events (e.g. likelihood of earthquakes and chances of not contracting the HIV virus after unprotected sexual intercourse, respectively). Last, despite the pervasiveness of the bias and its potential cost in real-life situations, the experiments also demonstrate what in our opinion is an impressive ability of subjects to incorporate information. In these complex experiments, subjects make correct predictions 64 percent of the time on average (ranging from 59 to 73 percent) whereas a perfect processor of information would be correct 69 percent of the time.

Chapter 3. The psychology literature has traditionally emphasized both the benefits of self-serving beliefs (mood improvement and happiness, willingness to accept challenges, etc.) and its cognitive costs (suboptimal assessment of risks, poor decision-making, etc.). In this chapter, Mellers and McGraw analyze the much neglected emotional drawbacks of self-serving biases. The key novelty of their "decision affect theory" is that they focus on the pleasure experienced after, rather than before, making a choice. The authors discuss two effects in the judgment of experienced pleasure: The existence of multiple reference points (see Chapter 8 for another analysis of anchoring) and the role of beliefs. In a first experiment, subjects choose between two different gambles. The authors show that the experienced (dis)utility of a gain (loss) in the selected gamble depends on three reference points: The status quo, the outcome under another state of the world, and the outcome of the gamble rejected. Interestingly, a small loss when the outcome in the other state and the other gamble are both highly negative can be more pleasurable than a small win when the outcome in the other state and the other gamble are both highly positive. In a second series of experiments, Mellers and McGraw show that surprise magnifies experienced utilities: Succeeding is most pleasurable for an agent who expected to fail and failure is most hurtful for an agent who expected to succeed. Decision affect theory has important implications for some well-documented judgment biases. Overconfidence is highly counterproductive: It makes success seem less surprising, and therefore less enjoyable, and it makes failure seem more surprising, and therefore more painful.

Hindsight bias has milder consequences: It makes events *ex post* less surprising, so successes are less pleasurable but failures are less painful.

This theory builds on two of the main on themes of this volume: Beliefs (Part I) and emotions (Part IV). It also raises several interesting questions for future work. For instance, if debiased individuals achieve a higher utility, we may expect that people force themselves to have accurate judgments when they face important decisions (just like they self-regulate their moods, see Chapter 11). Also, there might be a number of possible ways to "rationalize" the extra pain of failure after reporting an expected success: The individual's self-esteem and social image may have deteriorated, or he may have learned and revised downwards his ability. Last, one would like to know whether these multiple reference points and prior beliefs have a transient or long run impact on experienced happiness.

II. DYNAMIC CHOICES: CONSISTENCY, COMMITMENT, AND INTERTEMPORAL SEPARABILITY

The standard theory of dynamic choice is based on the time-consistency principle: In the absence of new information, optimal plans for future actions remain optimal as time elapses. Although consistent with the observed choices in a fairly important range of circumstances, this characteristic is, nevertheless, far from being universal. There is indeed both empirical and experimental evidence of systematic violations of this principle. Part II investigates two of the best-known departures from time-consistency: Hyperbolic discounting or the idea that immediate payoffs are "overvalued" relative to more distant ones (Chapters 4 and 5), and timing independence or the idea that planned risk-taking behavior after some uncertainty resolution does not coincide with actual choices (Chapter 6). Naturally, whether individuals anticipate their time-inconsistency or not has a crucial impact in their behavior.

Chapter 4. Behavioral economists have recently introduced some extensions in the modeling of individual preferences in order to enrich the predictive power of their theories. Hyperbolic discounting (also known as present-biased preferences) has been particularly helpful to explain some behaviors widely documented in the experimental literature, such as the tendency to postpone indefinitely costly actions with delayed rewards (starting a diet, organizing the office, stopping the consumption of cigarettes, etc.).

Given that present desires for future actions do not coincide with future desires for those same actions, individuals who anticipate their time-inconsistency will try and use different commitment devices in order to impose their current wishes. Chapter 4 provides a brief review of the main mechanisms employed. Brocas, Carrillo, and Dewatripont distinguish between interpersonal and intra-personal restraining tools. In the first category, the agent uses either market forces or contractual relations with third parties to restrict the future set of opportunities. In the second one, the agent regulates his future behavior without external

help through strategic ignorance: Information not acquired today cannot be (inefficiently) used in the future. In the language of Chapter 1, this manipulations of beliefs is rational and pro-motivated. The authors then focus on "promises," a very natural commitment device. They show that an agent may decide to make a promise anticipating that he will partly break it. Although this is a second-best solution, it still dominates not making any promise (or making a weaker one) because it succeeds in restraining, at least partly, the future behavior.

In the last section, the authors highlight the similarities between two apparently unrelated fields: Hyperbolic discounting and incomplete contracts. In both cases, agents suffer from their inability to make explicit commitments. Several devices (such as ignorance or side-contracts) are then used to restrain future actions and increase intertemporal welfare. From a general perspective, we believe that the two literatures have still much to learn from each other.

Chapter 5. If time-varying preferences has been a cornerstone of recent developments in behavioral economics, the effect on current utility of sentiments associated with past experiences (such as habits or memories of past episodes) and future events (anticipatory feelings like fear, anxiety, dread, or hope) has also been crucial to improve our understanding of human behavior. Although there is a growing literature in both domains (see, for example, Chapter 4 for a paper on hyperbolic discounting and Chapters 3, 10, 11, and 12 for some studies on emotions), the two issues have always been analyzed separately.

In this chapter, Palacios-Huerta argues that there is an intimate connection between hyperbolic discounting and recursive utility. The author hypothesizes that individuals endowed with time-inconsistent preferences use remembrance and anticipation as internal commitment devices to achieve a time-consistent behavior. Therefore, time-invariance is not an intrinsic characteristic of human preferences but rather the result of a skill acquisition process. To support this argument, Palacios-Huerta builds a simple model and shows that, for a suitably chosen inconsistency parameter, a traditional exponential discounting individual with additively separable intertemporal utility is formally undistinguishable from a hyperbolic discounting one with non-separable utility. The equivalence holds in knife-edge cases and, in particular, it never occurs if utility depends on memories but not on anticipation. However, it demonstrates the more general conclusion that sentiments can partly mitigate dynamic inconsistencies.

The chapter has two possible readings. First, it unfolds a simple but interesting relation between sentiments and relative weight of experiences at different dates. Second, it argues that sentiments are instrumental, an idea that Adam Smith already suggested more than two centuries ago. This controversial (and certainly more ambitious) idea that emotions regulate impulsive behavior deserves further empirical and experimental scrutiny.

Chapter 6. Standard rational models of dynamic choice under uncertainty impose several limitations in the behavior of individuals. Cubitt, Starmer, and Sugden review in this chapter the experimental evidence against some of the most

restrictive implicit assumptions: Frame-independence (the idea that the exact presentation of the problem to the subject should not matter), separability (that is, full integration of future choices and ignorance of past and sunk choices in current decision-making), timing independence (a consistency requirement between optimal choice planned if one event happens and choice selected once that event has occurred), and reduction (the fact that multi-stage risks can be reduced to one-stage risks where these risks are multiplied by the corresponding probabilities).

The chapter starts with a well-documented (static) anomaly: The common ratio effect. Subjects choose first between two alternatives with different risks, and then between the same two alternatives except that the probabilities of getting a nonzero payoff is multiplied by a factor smaller than 1. Expected utility theory predicts identical choices in both cases whereas the evidence suggests riskier choices the lower the probability of a positive payoff. Several theoretical studies have argued that the common ratio effect can be reconciled with the standard choice theory if we relax one of the four dynamic principles above described. The preliminary experimental evidence pointed at timing independence as the main operating factor behind the anomaly. However, subsequent experiments on dynamic decision-making under risk and uncertainty have revealed two striking results. First, violation of timing independence is largely unanticipated. Second, the common ratio effect may sometimes go in the opposite direction, with subjects taking fewer risks the lower the probability of a positive payoff. The authors conclude that it may be necessary to relax more than just one of the four principles in order to explain all the emerging patterns in the data, and that further research is necessary to determine which combination of anomalies is responsible for the observed behavior.

The chapter is a perfect example of the potential synergies between economic theory, cognitive psychology and experimental practices: Theories need to be developed around the empirical regularities discovered in the laboratory, experiments need to be conducted to guide theorists in their search of realistic models of human behavior, and findings in cognitive psychology must be incorporated to increase the predictive power of these models.

III. LIMITED COGNITION: ATTENTION, PREFERENCE FORMATION, AND RISK EVALUATION

Economic theories have been fiercely criticized for the excessive degree of sophistication it imposes on individuals. In simple words, detractors argue that "economic agents are too intelligent." Perfect foresight, perfect memory, perfect integration of information, perfect evaluation of every possible alternative, and absence of any emotional component in responses are just a few examples of the unrealistic abilities presupposed on the economic super-person. Lowering the agents' IQ is simple. The difficulty strives in determining which dimensions of

their capacity to reason should be weakened, in which way and by how much. The recent experimental literature has accepted this intellectual challenge. By translating the problem to the laboratory, researchers have been able to unfold some systematic patterns in the human cognitive limitations. Part III offers three representative examples of the systematic deficiencies in the cognitive process: Limited attention and ability to incorporate data (Chapter 7), existence and persistence of anchoring effects (Chapter 8) and biases in the evaluation of risks (Chapter 9). Note that other imperfect abilities are also studied in this volume (see, for example, the analysis of biases in information updating presented in Chapter 2). Last, contributions related to the drawbacks and limitations caused by moods, emotions, and other affective states are studied in a different section (Part IV).

Chapter 7. In most of the research in experimental economics, the designer relies on the observed decisions of subjects to draw inferences about their behavior. This follows the tradition of the neoclassical utility theory, which postulates that choices reveal preferences whereas self-reported information is, most of the times, biased, inconsistent, or just useless. In this chapter, Camerer and Johnson make a general yet important observation: Valuable information may come from sources other than choices. An obvious but nonetheless sharp example is the fact that subjects cannot use evidence that has not been acquired (or, equivalently, that has been overlooked) in a first place. The authors call "process data" the method that consists in analyzing how people acquire and incorporate information. In a series of experiments, Camerer and Johnson show that process data can be useful in two ways. First, when subjects do not play according to game theoretical predictions, knowing which information has been used and which one overlooked can help discriminating between different limited cognition theories. Second, equilibrium choices may or may not be the result of a rational strategic analysis, and process data can be useful to determine the level of sophistication in the reasoning of subjects.

The major conclusion of the experiments reviewed by Camerer and Johnson are the following. In sequential offer bargaining games, the basic though non-intuitive "think backwards and play forwards" game theory principle is rarely observed: Subjects overlook (important) future nodes and concentrate their attention in the (irrelevant) first node. In forward induction signaling games, players ignore the foregone payoff of their opponents even though it may affect their current behavior. Last, in simultaneous games, most subjects either do not play strategically or play strategically under the assumption that the opponent does not play strategically.

The chapter discusses games of complete information or, more exactly, games where information is hidden but freely available to all parties. This is the natural first step. However, it seems that the "process data" technique could be fruitfully extended to analyze also games of asymmetric information, games of incomplete but symmetric information, and games of public information in which only one of the players has the capacity to acquire and diffuse the news.

Chapter 8. In the neoclassical utility theory, demand for consumption goods is derived from fundamental preferences. Under reasonable assumptions, one can show that individual demand curves are stable and downward sloping. This beautiful theory contrasts with the classical experiments conducted in psychology, which highlight the non-negligible effect of "framing" and "anchoring" in the consumption choice of individuals (see, for example, Chapter 3).

This chapter takes a further step in this direction. Ariely, Loewenstein, and Prelec conduct a series of experiments in order to determine whether individual valuations are stable and coherent. The authors expose subjects to a sample of pain (an unpleasant sound played over headphones) and ask them to set the prices at which they are willing to accept pains of different duration. Their main conclusions are summarized as follows. First, valuations are strongly influenced by anchoring: The initial price proposed in exchange of the painful experience partly determines the prices asked by subjects in the subsequent trials. Second, valuations are remarkably coherent within individuals: Subjects react to an increase (decrease) in the duration of the sound by asking a higher (lower) price in order to accept the experience. Third, repetition, random generation of anchors, size of stakes, and market determination of prices through a bidding procedure do not alter significantly the first and second conclusions. The authors label this combination of initial malleability of preferences and remarkable stability once imprinted as "coherent arbitrariness."

This chapter is another excellent illustration of the imperfect predictive power of the neoclassical theory. The final experiment posits, albeit more tentatively, that with anchoring it may be possible to manipulate not only the size but even the sign of valuations, that is, whether subjects want to pay or to be paid for an experience. Despite the importance and well-documented pervasiveness of the phenomenon, one may still wonder if size of stakes is really a neutral variable: Are home buyers as easily influenced by an unreasonable asking price as students bidding for a mug? In our view, this question deserves further attention.

Chapter 9. Standard rational economic theories assume that perception is objective and perception is absolute. Yet, there is a large body of evidence that contradicts this view. In this chapter, Weber argues that building theories that incorporate subjectivity and relativity in the study of perception can substantially improve the predictive power of economic models. The chapter starts with a brief review of recent behavioral theories that acknowledge a subjective (prominence, framing as in Chapter 12, etc.) and a relative (social comparisons, anchoring as in Chapters 3 and 8, etc.) element in perception. The author then presents a scientific discipline with a long tradition called "psychophysics." The goal of researchers in this area is to find empirical regularities in the relation between objective stimuli and subjective experiences. Early work in psychophysics shows that, in general, perception is relative: Humans are predisposed to sense changes in stimulations rather than absolute levels. Also, judgment of confidence is backward- and

inward-looking rather than forward-looking: Instead of trying to predict the accuracy of their answer, humans let the process by which they arrive to their conclusion influence the confidence of their judgment.

The last section of the chapter illustrates how psychophysics can successfully be integrated in economic analyses. There is evidence that perceptions are subjective and relative not only for simple sensory judgments but also for behaviors more relevant for economics such as risk-tolerance. Recent research shows the existence of systematic differences in the perception of financial and health risks by individuals of different groups (gender, culture, etc.). This means that, contrary to the standard view, entrepreneurs differ from other individuals not by a more positive attitude towards risk but rather by a more positive perception of it. More intriguingly, risk-return models based on relative risk (i.e. standard deviation as a percentage of the mean) describe and predict behavior much more accurately than those based on absolute risk (i.e. standard deviation alone). This predisposition may explain the differences in the risk-taking choices found in the laboratory when the size of stakes are modified.

The relative nature of judgments and decisions is undeniable. In our view, the main challenge to construct a normative economic framework that incorporates in a systematic way psychophysics theory is the difficulty to isolate the "relativity" effect. Trivially, a worker may prefer a $200 raise when his colleagues get $100 rather than a $300 raise when everyone else gets $500 simply due to the signal conveyed by the firm and the natural implications for future firing and promotion decisions. Weber's research clearly shows that something deeper is going on. However, to fully convince skeptics about the generality of the theory, the relative perception hypothesis should ideally be tested directly against the competing ones.

IV. AFFECTIVE BEHAVIOR: THE ROLE OF EMOTIONS IN DECISION-MAKING

The rational economic agent is cold. Either he is incapable of experiencing basic emotions (such as fear, dread, anger, anxiety, regret, disappointment, apprehension, hope, joy, and excitement) or feelings have no impact on his decisions. This assumed immunity of subjects to affective states contrasts with the observed human tendency to misbehave (or just to behave differently) under emotional pressure. Psychological research has unfolded important patterns of affective behavior. Part IV of this volume collects a number of findings in this domain: The defensive mechanisms employed by individuals to avoid negative emotions like regret and disappointment (Chapter 10), the capacity of subjects to regulate their moods (Chapter 11), and the emotional component in the valuation of the loss of chance to live (Chapter 12). Last, although there is still a long way to go, it is fair to acknowledge the increasing attention paid by economists to emotions and their effect in choice, as witnessed for example by Chapter 5.

Chapter 10. Freedom of choice is usually desirable. However, it also entails some missed opportunities. When the selected alternative does not meet the expectations, individuals may experience negative emotions such as disappointment or regret. In this chapter, Tykocinski and Pittman study two psychological costs suffered by individuals due to the existence of (and the inevitable choice between) several alternatives. This cost complements the more basic negative value of increased choices analyzed in Chapter 4 for individuals with time-varying preferences.

The first effect is called "inaction inertia." In a series of experiments, the authors show how individuals who missed the opportunity to enjoy a high gain may decide to pass up a subsequent chance to enjoy a positive but less important one. Although, some traditional theories (such as dissonance reduction, self-signaling, anchoring, or learning about one's preferences) could partly explain this choice, the authors argue that avoidance of regret is the main driving force behind this behavior. Missing a great opportunity makes the subject vulnerable to regret. The rejection of a posterior smaller reward is just a self-defensive mechanism whose objective is to avoid painful memories. The second effect is "retroactive pessimism," roughly defined as the attempt to convince oneself that an outcome which turned out to be negative was indeed inevitable. Although related to the well-known hindsight bias (see Chapter 3), retroactive pessimism is an emotional (rather than cognitive) and motivated phenomenon directed to overcome disappointment. Tykocinski and Pittman review some experiments that display this tendency to *ex post* consider outcomes to be more predictable than they actually were. They show that this force is especially marked for negative rather than positive results (voters who supported the losing party) and for significant rather than small losses (a missed discount of substantial value).

The idea that options can be psychologically damaging and that individuals develop defensive mechanisms (inaction and misinterpretation) to overcome that cost is extremely appealing. Besides, it might help explaining well-documented phenomena, like the pervasive and highly detrimental tendency of stockholders to hang on to losers. Developing further experiments based on real choices and explicit payments rather than hypothetical questionnaires would give even more strength to the conclusions obtained by the authors. Ideally, experiments should be designed in a way that standard theories such as learning, anchoring, and signaling would fail to explain the observed defensive behavior.

Chapter 11. Social psychologists have long recognized that affect can influence judgments and choices. Erber, Erber, and Poe study to which extent can individuals separate moods from cognition in their decision-making. The traditional literature is based on the mood repair hypothesis, which basically says that individuals maintain positive moods and combat negative moods. The authors argue that this pleasure seeking and pain avoidance hedonist view is simplistic and inaccurate. They present, as a casual example, the fact that we often watch

and enjoy sad movies, and claim that mood management is goal oriented much like motivations and beliefs (see Chapter 1). It also requires willingness and capacity.

To support this observation, Erber et al. propose some experiments where the willingness and ability of subjects to manipulate their mood depends on some external factors or constraints. In the first experiment, the authors show that when subjects have to work on their own, they prefer mood congruent tasks (work on cheerful stories if they are happy and on depressing ones if they are sad). By contrast, if they need to work with a stranger, they prefer mood incongruent tasks, as a way to regulate their affect prior to the social interaction. In the second experiment, subjects read stories that affect their mood before undertaking an unrelated task. When stakes in the task are low, subjects do not feel the necessity to attenuate their emotions and therefore choose mood preserving stories. By contrast, when stakes are high, subjects deliberately select mood incongruent stories in order to reach a neutral affective state that would help them to succeed in the important task. Overall, this theory does not reject the idea that happiness and other optimistic attitudes may induce individuals to behave suboptimally. However, it claims that such inefficiency should not be overemphasized: When decisions are important, agents are likely to turn their moods into a neutral state before acting. Last, note the difference between this direct positive effect of self-management of emotions and the indirect negative effect that inaccurate beliefs may have on feelings (Chapter 3).

Chapter 12. The value of life has generated controversial debates, mostly in Law and Health Economics. In this chapter, Koehler studies optimal compensation schemes for a lost chance to live. Strikingly, the traditional tort principle follows an all-or-nothing *ad hoc* rule, where full damage is acknowledged if negligence reduces the chance to live by more than 50 percent and no damage is acknowledged otherwise. Recently, a more flexible "loss of chance" doctrine is being applied, whereby liability is an increasing function of the percentage loss in the chance to live, should the loss actually occurred or not. Two rules have been proposed to determine damages under this doctrine: Proportional, defined as patient's value of life times percentage lost due to negligence, and discretionary.

In valuing the loss of chance, the author argues that well-documented behavioral anomalies should be taken into account. In particular, prospect theory states that individuals adopt a reference point and a marginal loss at that value is disliked more than a marginal gain is liked. The optimal rule will therefore depend on the location of the probability of survival reference point (pre-negligence probability, post-negligence probability, 0, 1, etc.). Similarly, framing (i.e. whether the negligence is presented as a decrease in the chance to survive or an increase in the chance to die) and certainty effects (i.e. whether the death probability increases from 0 to x or from $1-x$ to 1) can also affect judgments substantially.

From incentive theory, we can conclude that the loss of chance doctrine is indeed the most efficient compensation scheme. Also, the behavioral theories presented by Koehler seem very relevant in this context. However, even if we decided to keep the standard expected utility framework, it would be necessary to address other issues. For example, most of the medical choices involve tradeoffs between probability of survival and life quality. It is, therefore, difficult to distinguish between negligence and optimal expected choice. On the other hand, liability for medical malpractice should not be restricted to increase in death probability but also include decrease in life quality, like permanent handicaps. The proportional rule could easily be extended to include this possibility. Last but not least, as the author acknowledges, loss of chance cases are usually heard only if a severe damage has effectively occurred. This implies that decreasing the probability of survival from 100 percent to 90 percent is more likely to go unnoticed than decreasing it from 10 percent to 0 percent. Ideally, the compensation scheme should correct for this bias. All in all, we believe that addressing these and other related theoretical issues would increase the power and applicability of this important doctrine.