Abstract

I propose a novel model of the human ego (which I define as the tendency to measure one's value based on extrinsic success rather than intrinsic aptitude or ability). I further propose the conjecture that ego so defined both is a non-adaptive by-product of evolutionary pressures, and has some evolutionary value as an adaptation (protecting self-interest). I explore ramifications of this model, including how it mediates individuals' reactions to perceived and actual limits of their power, their ability to cope with risk and uncertainty, and how this model may interpolate between rational choice models and cognitive psychology. I develop numerous examples and applications, including poverty traps, to demonstrate the model's predictive power to elucidate a broad range of social phenomena.

An evolutionary psychology model of ego, risk, and cognitive dissonance

Baruch Feldman

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1 Introduction

An extraordinary exchange has taken place in recent decades between psychology and other social sciences, particularly economics. Neoclassical economics traditionally modeled people's behavior in the economic arena by assuming they make decisions rationally – an assumption exposed increasingly to revision based on observational evidence [1], most notably with groundbreaking work by psychologists such as Kahneman [2]. At the same time, and perhaps even more remarkably, the simple *deductive* assertion that much behavior ought to serve rational ends – grounded in the observation that optimization may provide its bearer with advantages (both evolutionary and economic) – has begun making inroads in social science [3, 4, 5] and psychology. The advent of evolution-based approaches to psychology [6, 7, 8] led to serious consideration of the hypothesis that behavior often serves adaptive purposes [9, 10, 11].

Rational choice has been invoked as an explanation in a broad range of social phenomena [4, 5], while psychological egoism argues that all behavior is ultimately motivated by self-interest [12, 13]. Certainly, both self-interest and material wealth factor into many arenas of human and social behavior. For instance, Harold Lasswell's celebrated definition of politics as "who gets what" clearly involves self-interest and the distribution of valued resources. And economics and resource scarcity notably figure in explanations for armed conflict and strife [14].

Yet observed behavior is not always rational. Behavioral economics has been applied to understand consumer and labor behavior, even when these depart from the normative expectations of economics and rational choice theory [1, 2, 15, 16]. Behavioral insights such as prospect theory have been applied to elucidate explanations of outstanding problems in economics [1].

An evolutionary psychology perspective contributes further to an understanding of irrationality by clarifying that cognitive and behavioral processes can be adaptive, at least for problems common in an evolutionary context, yet simultaneously be sub-optimal in a modern, organized, technology-based economy. In particular, behavior (including apparently irrational behavior) results from a rich, bi-directional interplay between genes, environment, and culture, and evolved universal tendencies may or may not fit the exigencies of a given, proximate environment [7, 6, 8]. Evolutionary psychology has had successes in explaining many phenomena, while challenges remain [6].

Psychologists agree that self-esteem is pervasive, important, and can affect behavior [17, 18, 19]. Yet many aspects of self-esteem remain controversial or mysterious, including the relative importance of self-esteem as a temporary state *vs.* permanent trait, as a sum of bottom-up parts *vs.* a top-down whole, and as a cognitive *vs.* affective process [20, 21]. Two competing explanations have been presented for why humans are motivated to grow and protect self-esteem: terror management theory (TMT) [17] and sociometer theory [22]. The present work hopes to shed light on how the self-esteem instinct works in practice, including its relationship to rationality.

1.1 Research question

> "You call these baubles, well, it is with baubles that men are led.... Do you think that you would be able to make men fight by reasoning? Never.... The soldier needs glory, distinctions, and rewards."
>
> -Napoleon Bonaparte, speaking about honorific rewards given to members of the Legion of Honor [25].

The concept of human rationality, as referenced in the present work, differs somewhat from most of the psychological literature on rationality [1, 10, 26], where it typically refers to whether people solve logic problems correctly, or whether they make *isolated* economic decisions as would be predicted by neoclassical economic theory. Instead, here I use rationality in a more *generalized* economic and political sense of acting in one's self-interest.[1] Thus the present work is motivated, in part, by a very fundamental question, inspired by economics: why might people behave in ways contrary to their own adaptive self-interest, even when it should be possible to learn over time from mistakes?[2] How can they sometimes have trouble even recognizing behaviors in their own self-interest? And more specifically, why do people engage in over-sensitive behavior? Why do they at times pay inordinate attention, even to the point of obsession, to points that apparently have no economic or practical relevance to their lives?

The question is vividly exemplified by the well-known quote above, showing that Napoleon (cynical or not) claimed a *reliable, repeatable* effect wherein large numbers of French conscripts (some of whom had perhaps revolted for democracy a few years prior) could be motivated by "baubles" to wage war on behalf of empire. By Napoleon's admission, "reasoning" would not suffice to motivate soldiers to risk their lives for his expansive campaigns, yet "baubles" symbolizing "glory" could.

Similarly, another key mystery I explore here is *voluntary under-investment* in one's own human capital, or that of one's close kin [1, 32, 27]. For example, why would a person consistently opt against educating oneself or one's children, starting a business, or training for a more rewarding career, even if such investments are clearly worthwhile? By the same token, why would one *over*-invest in oneself, erroneously assuming (again like Napoleon) that one cannot fail? Why would even a professionally successful individual hesitate to make a career or life change? Why are more fortunate individuals observed to feel less empathy [28] towards misfortunate ones?

The present work explores a hypothetical response[3] to the above: that human behavior can be analyzed rationally (at least insofar as straightforward logical models can capture the complexities inherent in "acting in one's self-interest"). Conversely, apparently *irrational* behavior becomes likely when uncertainty, risk, and ambiguity [5, 29] are dominant considerations (as well as the need to prioritize and conserve energy [11, 10]). The rational explanations I offer involve self-image (the perception of one's likelihood to succeed) and risk (the adverse consequences of failure). Yet the whole is more than the sum of these parts: I hope to illuminate how adaptive considerations, mitigated by cognitive dissonance, result in non-adaptive behavior.

In this work, I present a model of the ego as a powerful evolutionary instinct that may help explain in rational terms much otherwise mysterious behavior. I propose that studying ego, in the model conceptualized here, is worthwhile because it addresses the *interaction* between individuals' desires and external reality. As such, it can tell much about how individu-

[1] This construct of rationality is similar to psychological and rational egoism. Note that I treat rational and adaptive behavior as closely-related ideas. But here I go beyond narrowly construed self-interest and ask why some behavior is maladaptive, *i.e.* serving no apparent self-interested *or* altruistic purpose.

[2] Simply dividing the mind into affective and deliberative systems leaves it moot whether and how the older affective system protects adaptive self-interest, or deals with risks.

[3] This work may be understood as an attempt to probe the limits of a 'radically rational' model of human behavior, a *homo economicus* [3] or even *politicoeconomicus*. Note such limits clearly do exist: Kahneman [26] wrote despite criticism by rational choice theorists and others, that irrationality research "merely rejects an extreme thesis that would attribute rationality to every belief and act." And even Tooby and Cosmides [11] concurred, writing "[r]ational behavior is not, in any sense, the state of nature." A middle ground is proposed here: to analyze irrationality with adaptive/rational considerations.

als cope with, and react to, limitations of their locus of control (*i.e.*, their perceived power to shape their environment according to their own preferences), as well as how they cope with their own vulnerability. In what follows, I seek to demonstrate that this model possesses parsimony of assumptions and, in Sec. 5, that it has general applicability.

Some have protested that the assumptions of evolutionary psychology can be replaced by a domain-general stipulation of rationality [6]. Yet I propose that an evolutionary perspective on ego can be useful to explain and motivate both irrational and rational behaviors through a lens of rational considerations. As formulated here, ego paradoxically is both rational and irrational, both adaptation and by-product – much like human behavior more generally [6, 7]. By referencing ideas such as cognitive dissonance (CD), operant conditioning, and ego depletion, I hope the present work can also help bridge the gap between cognitive and evolutionary psychology.

Sec. 2 summarizes the central thesis and definitions in this work, while Sec. 3 elaborates on the connection to evolutionary psychology and Sec. 4 on the connection to the theory of cognitive dissonance. Although this is a largely speculative work, as evidenced by the large number of hypotheses presented, Sec. 5 applies the ideas developed here to many practical examples, thereby demonstrating their predictive power.

2 Ego: theoretical framework

2.1 Definition

To make the model of ego precise, I seek to define precisely the central term. Ego is defined here as:

Definition 1 *Ego is measuring one's own value based on extrinsic success, rather than intrinsic aptitude or ability. Further, the self-worth determined in this way is used to assess one's future possibilities and therefore to make decisions.*

The decisions alluded to here as being affected by ego could include, *e.g.*, decisions to make human capital investments in oneself, or to take life risks such as pursuing difficult-to-attain goals.

Note that this definition is already somewhat novel, and is a crucial part of this work (see, however, Ref. [20] and the discussion in Sec. 2.3). At the same time, the definition overlaps with many existing concepts and is quite natural (to be illustrated and elaborated in Sec. 2.3 below).

The meaning of "success" here is deliberately left subjective. Modern human goals are framed and motivated by evolutionary instincts, even if they do not cleave to a purely evolutionary mandate [8]. Thus I propose that, when indulging their egos, humans tend to gauge their own "fitness" by measures that, broadly speaking, correlate with *extrinsic* economic and reproductive outcomes. By the same token, the focus of Definition 1 is especially on success as it is measured *directly* by evidence from the senses. Thus, for some individuals, consumption, whether in the form of "retail therapy" [23] or gastronomy, may provide a more immediate boost to the ego than does saving [15, 16].

Finally, it is interesting to note that Definition 1 fails to differentiate between failure caused by incidental circumstances *vs.* failure by one's own fault – *e.g.*, because the original aspiration was wrong or unworkable, or because of one's lack of ability. In practice, when circumstances are inauspicious, this question of fault may be irrelevant, and ego may in fact offer an advantage by discouraging wasted effort. Nevertheless, the distinction often is crucial, and the ego is flawed inasmuch as it fails to distinguish between an outcome *vs.* a possibility (by extension, ego erroneously conflates phenotype with genotype [7, 8]).

2.2 Central thesis

My central thesis:

Hypothesis 1 *Ego (as in Definition 1) is a strong, innate instinct. It originates both as an evolutionary adaptation (protecting self-interest) and as a non-adaptive response to evolutionary pressures.*

Arguably, every decision we make involves the ego, and therefore ego touches on every aspect of our lives. But at the same time, ego inhibits risk-taking and

living one's most compassionate, dynamic, innovative life.

An alternative or complementary perspective on Hypothesis 1 is the following:

Hypothesis 2 *In Definition 1, the phrases "one's own value" and "self-worth" could be understood to mean one's self-assessment of one's own evolutionary fitness.*

Hypothesis 2 implies that evolution has "imprinted" on us the fear of being reproductively unfit, so that we tend to perceive even mundane, modern challenges through this frame. While Hypothesis 2 is not self-evident from Def. 1, it does help account for the seriousness individuals sometimes impart to seemingly minor threats or successes, which can become imbued with evolutionary overtones of life and death. This will be explored more fully in Sec. 3 below.

2.3 Discussion, illustrations, and related literature

In this section I expand and clarify Def. 1 with both a review of related literature, and illustrative examples.

Def. 1 affects one's locus of control and thereby one's pursuit of life goals, including one's openness to risks. This "feedback loop" among ambitions, ego, and outcomes may be self-reinforcing. In addition to causing a possible "poverty trap" [15, 27], this "loop" resembles taking a Bayesian statistical approach to one's own life possibilities, *i.e.*, revising one's conception of oneself in response to observed life outcomes.[4]

[4]For example, suppose one's "true" genotypic abilities are unknown even to oneself, and therefore modeled by a random (scalar or vector) variable χ with a probability distribution $\rho(\chi)$. Positive and negative life events (as gauged by the affect they produce) can revise one's estimate of ρ. Now if one wishes to make an investment in oneself such as attending a university, one's rational consideration of the risks and payoffs of this decision will be affected by ρ. In effect, the likelihood of success in a new endeavor depends sensitively on the likelihood ρ that one is "capable enough" to succeed. Both the risk of failure and the expected payoff can depend on ρ, such that even attempting the investment may seem futile if one believes success to be limited or precluded by one's own ability level. Positive or negative life events can shift ρ to make self-investment appear more or less attractive, and thus success and failure can be self-reinforcing.

Def. 1 might further be understood with reference to the "just-world hypothesis" [33] or to the common expression, "it is hard to argue with success."

Similarly, snobbery [24] and exclusivity (*e.g.*, the medieval 'divine right' of royalty and aristocracy) have much in common with Def. 1 of ego. The existence of such attitudes benefit favored groups, who are assumed to deserve favored social and economic status by virtue of some (often ill-defined) innate superiority. However, for the purposes of the present work, it is particularly interesting to speculate that such attitudes exist and are widespread precisely because human psychology has evolved to accept – and expect – dominant individuals and groups [8]. By the same token, nationalism and xenophobia also emphasize favored (co-ethnic) in-groups, yet may do so for defensive reasons, as political units such as the nation-state may function largely to protect civilians from invading foreigners [34]. Thus by protecting individuals and groups who would otherwise be threatened, nationalism and xenophobia may provide an ego boost according to Def. 1 and Hypothesis 2.

In modern capitalist economies, some observers see a "meritocracy" where those who enjoy economic success probably deserve it because of their merit. Arguably this view reflects contingent ego, as genotypic merit is presumed to correlate strongly with phenotypic success [35, 36, 37, 38].

Attribution theory [19, 30, 28] addresses many of the same themes as the present work, including dispositional *vs.* contextual attribution, and self-perception. The present work takes this further, exploring the connection of Def. 1 with evolutionary psychology as a largely unconscious, powerful, and innate phenomenon. Def. 1 is similar to attributional ego [19] for the positive case, where both predict individuals take credit when successful, but attribution theory appears opposite in the negative case, where it predicts individuals avoid blame for failure. Unlike attribution theory, here I posit that ego remains active for either positive or negative events, and that contextual self-perception functions to defend against threats to ego.

There exists a sizable literature in a closely related concept, contingent self-esteem, which is defined as self-esteem that is contingent on meeting external

standards [17, 31]. While this definition is very similar to 1, in practice contingent self-esteem may be used as a proxy for the *fragility* of self-esteem.[5] The present work, by contrast, puts emphasis on the *contingent source* rather than strength of self-esteem. More fundamentally, Definition 1 emphasizes that ego depends on outcomes of economic/evolutionary *relevance*[6]. For example, in the spirit of rational choice theory, a person experiencing a workplace or political argument seeks support of others, not just for validation, but because such support improves the political position and likelihood of prevailing. Likewise, a person tends to seek professional recognition because of the advantages it brings to his/her career. Thus, even at an unconscious level, ego depends on life outcomes in response to their perceived relevance. Moreover, in the present conceptualization, (extrinsic) ego is a universal instinct, cannot be eliminated, and is thus applicable to analyze all people, not only those with fragile self-esteem. Accordingly, the present concept of ego need not imply sensitivity and passivity: one may strive for a positive outcome, and still feel ego pressures, which are typically made all the stronger by one's investment of self. Additionally, the present work treats positive and negative outcomes more evenly, in that the ego is not only bombarded by negative life events, but can also grow inordinately *large* in response to *desired* outcomes [19, 32, 28].

An even more important difference is that ego is not exactly self-esteem, rather more of a pragmatic yardstick of one's power, and is therefore inter-related with desire, greed, fear (see Hypothesis 6 below), etc. For the present purposes, 1 can be considered to *define* ego. That is, the model presented here defines a construct but then shows that this construct is useful for predicting cognition, affect, and behavior in many cases. By contrast, despite broad consensus that self-esteem is important, psychological literature remains ambivalent over fundamentals like why we need self-esteem [17, 22], and finds little evidence for association between self-esteem and behavior, while simultaneously failing to tap self-esteem's full explanatory potential for behavior [20]. Even theories explicitly considering self-esteem's grounding in a desire for "literal or symbolic immortality" [17] neglect ego's source in that very *ubiquitous, biologically-ingrained* craving for 'longevity' – passing on our genes to the next generation – and the concomitant reproductive fitness concerns, selection pressures, and powerful direct implications for *behavior*.

Within the contingent self-esteem literature, Crocker and Wolfe [20] have proposed a model similar to Def. 1, where self-esteem is contingent on personally significant events, and influences behavior. Based on this, they aim to resolve controversies and explain social problems' connection with self-esteem. The present work is in many ways complementary to [20]. It differs by emphasizing ego's interplay with rationality, as well as explicitly assuming the contingency of ego is innate, and exploring the connection via Hypotheses 1 and 2 to evolutionary psychology, risk, and CD in detail. And as discussed above, here I emphasize ego's contingency on economic/evolutionary success and factors socially accepted as relevant to it [8]. Whereas Crocker and Wolfe do write that "Broad, superordinate contingencies of self-worth ... are not likely to change easily or quickly," they focus their analysis more on personally variable bases of contingency [20].

Likewise, Tooby and Cosmides [7] give an example connecting self-esteem to sexual jealousy that touches on many of the same ideas explored here. However, they do not explicitly state a general, innate relationship between self-esteem and extrinsic factors, nor do they elaborate on self-esteem's connection to risk, risk-aversion, and cognitive processes like CD and operant conditioning. In any case, little previous work[7] has addressed in any detail the ramifications of contingent self-esteem and their explanatory and predictive power for a broad range of behavior.

[5] *E.g.*, consider measures such as [31] "If I am told that I look good, I feel better about myself in general" and "An important measure of my worth is how well I perform up to the standards that other people have set for me."

[6] *Cf.* Goldthorpe's [5] discussion of universal *situational* rather than personal factors in decisions, and Gilbert [8].

[7] The work of Crocker and Wolfe [20] is an exception to this rule. As they write: "In our view, behavior is motivated more by actual or potential fluctuations in self-esteem around a person's typical level than by whether that level is typically high or low."

The definition of ego given here may be most closely related to Buddhist religious thought, which has explored the human ego deeply, with special emphasis on alternatives to egoistic thinking. Consider the following quote, spoken by a Zen Buddhist master [39]:

> The spider dances her web without knowing that there are flies who will get caught in it. The fly, dancing nonchalantly on a sunbeam, gets caught in the net without knowing what lies in store. But through both of them 'It' dances.

In evolutionary terms, this Buddhist master seems to recognize that spider and fly are part of a single complex ecosystem ('It') including symbiosis and altruism together with competition. It is also interesting to note that Buddhism emphasizes the value of compassion in contradistinction to ego [8]; it is immediately apparent from 1 that ego encourages negative judgement of others who suffer misfortune, and therefore impedes compassion. Finally, Buddhism also stresses giving up or losing one's ego as a path to greater success, for example in various arts [39]. In the language of the present work, this might be understood as the realization that failure does not equate with death, and therefore one is free to take risks. Despite these many similarities, Buddhism differs from the present work in that it does not traditionally study the ego rationally, and indeed Buddhist tradition often disparages rationality as insufficient or incapable of attaining enlightenment, sometimes instead making use of riddles and paradoxes to shock the adherent's mind out of rational thinking.

I noted in Sec. 2.1 that ego erroneously conflates outcomes with potential. I should note that epigenetic effects whereby acquired traits can be passed on to offspring, the Baldwin effect wherein learned adaptations affect natural selection, and the complex interplay between environment and human nature acknowledged by evolutionary psychologists [6] all give some justification for organisms to measure their self-worth by extrinsic success in a dynamic environment rather than by intrinsic qualities. Nevertheless, it is still erroneous to measure potential this way, since outcomes are, for these very reasons, *not* fixed, predetermined functions of one's "fitness."

2.4 Risk-reward calculations

Virtually everything I discuss in this article can be interpreted from an adaptive-evolutionary perspective in terms of mitigating uncertainty and limiting risk:

Hypothesis 3 *Egoistic thinking tends to favor risk-aversion.*

Since ego, as modeled in Def. 1, is measured by extrinsic outcomes, and particularly by overt information from the senses, it is a *fundamentally* risk-averse trait. In a fundamental way, the misattribution of credit or blame to oneself, for outcomes partly dependent on luck, tends to encourage conservatism towards risks.

One way to understand Hypothesis 3 is the following: in Def. 1, ego is determined by one's extrinsic success, and determines, in turn, one's assessment of *future* life possibilities. Interpreting these facts from a "systems" point of view – ignoring the individual's feelings and considering only inputs and outputs – we see Def. 1 is a *mechanism* by which people tend to base expectations of the future on extrinsic *realities*, as opposed to hopes and aspirations. Def. 1 has little tolerance for "could have, would have, should have," rewarding only results one can see and measure. Such thinking is onerously risk-averse, trusting only what is observably true, and leaving little hope that new outcomes may be possible.

Moreover, in protecting one's ego, one seeks to protect one's emotional well-being, which goes beyond merely eschewing risk to one's *material* well-being (as discussed in Sec. 4 below). Finally, there is a possible adaptive reason for ego's connection to risk aversion, since a more successful social position should generally provide a safer foundation to tolerate risk [32].

Note that strictly rational planning and decision-making may well be ineffective and even unattainable strategies in human life, since complex and unanticipated factors can render a perfectly correct plan useless – or even dangerous – in practice. Thus, 'the best-laid plans of mice and men go oft awry.' Despite having advanced cognitive capabilities, humans

may typically treat prediction and planning as semi-empirical problems – particularly when thinking in intuitive or instinctual modes. This strategy of depending on experience and highly evolved instinct may reduce the *risk* of decision-making – but also limit the *rewards* from taking well-chosen risks. Indeed, to the extent that humans tend to consult an "affect pool" and "affect heuristic" when making decisions [40], it stands to reason their decisions would reflect tried-and-true experience, rather than innovative risk-taking.

To elaborate further on how ego should suppress risk-taking, consider a crude game theoretical model. Let us imagine a world where people behave according to the ego of Def. 1, and that all crave the same risky life goal. Imagine, also, that this goal is attainable purely by luck, with success in just one try out of five. Then the majority who failed to attain the goal on their first try would internalize the failure, judging their future life possibilities as lower than those of the minority who succeeded. They would perhaps be unlikely to try again, particularly if doing so carried costs. Although this model is admittedly exaggerated, it arguably captures much that's missing from zero-sum political models, which emphasize all-out competition for a few scarce resources.

In economics, self-control problems can prevent workers from investing [1, 15, 16] optimally when payoffs are delayed in time from the investment. Similarly, in operant conditioning theory, training a long and difficult behavior sequence is made much easier by providing partial rewards during the course of the sequence [41]. A simple adaptive-rational consideration that can explain such apparently irrational tendencies is the *risk* that a deferred payoff will fail to materialize.

By discouraging risk, ego could play a role in poverty traps (Sec. 5.1) by making human capital investments in oneself seem tenuous and uncertain [27]. It may also encourage conformism and groupthink rather than independence by glamorizing commonly accepted measures and modalities of success. And overreliance on ego could undermine the ability of dreams, ambitions, imagination, and plans to materialize ideas into reality.

Note that the relationship between ego and risk-aversion could be bi-directional, *i.e.* risk-aversion could cause egoistic thinking. For example, in the case of misfortune or dissatisfactory extrinsic outcomes, a person might harbor a lower ego as a defense mechanism against the risk of repeating a choice that has led to such misfortunes. Thus, any discrepancy between a person's intrinsic self-esteem and extrinsic ego might be explained as a defense against risk.

Finally, I note that, in the present model, risk and uncertainty act as natural counterweights to rationality. That is, to the degree that an individual cannot successfully influence his or her environment, that behavioral options are unavailable that produce truly desired outcomes, and that predicting consequences of a choice is difficult, it appears unprofitable to the individual to invest energy in rational deliberation.

3 Evolutionary perspective on ego

In the debate over the *purpose* of self-esteem, sociometer theory tends to interpret self-esteem as adaptive [22], whereas Terror Management Theory sees it more as a by-product or reaction to the "existential dilemma" of all humans [17]. Yet an evolutionary psychology perspective allows the possibility that ego is both; indeed, Gilbert writes that virtually all human characteristics have an adaptive side but can be anachronistic in modern societies [8]. In this section, I largely agree, considering in turn the adaptive and non-adaptive characteristics of the ego model from Sec. 2. In the process, I hope to illustrate one way [11] that evolutionary models could mediate the rationality debate [10].

3.1 Ego as an evolutionary adaptation

First I consider the possible adaptive functions of ego. It is virtually certain that natural selection should produce some adaptation that, like Def. 1, imparts us with self-interest. Thus, broadly speaking, ego can serve the evolutionary purpose of helping protect

the individual's interests, including when they conflict with the interests of others. As such, it is surely reasonable that ego would be a strong instinct as in Hypothesis 1, given how many of the adaptive problems we solve are in the service of our greater self-interest. Note this adaptive value of ego is particularly relevant in establishing the connection of human behavior to rational egoism, and thus to rationality, in the economic sense [11].

As discussed in Sec. 2.4, ego also could play the role of preventing extraneous risk:

Hypothesis 4 *Ego serves an adaptive purpose of reducing risk. More precisely, ego is an evolved system for mitigating and preventing risk.*

The relationship of ego to risk will be explored further in Sec. 4.2. Still, this is not to say ego is necessarily optimally adapted for risks that occur in a modern organized economy:

Hypothesis 5 *Being an instinctual system, ego favors decision heuristics such as loss-aversion rather than rational optimization [2, 10, 40].*

The non-adaptive or sub-optimal side of ego will be discussed further in Sec. 3.2 and Sec. 5 below. A related adaptive advantage of ego may be to conserve mental energy by cutting off deliberation about too many remote risks. Thus, ego is an evolved system for conserving energy and avoiding risk by defaulting to a safe option analogous to the reference point of prospect theory [2, 1]; see the discussion around Hypotheses 7 and 9.

Some *direct* evidence for ego as an evolved system is provided by the theories of conditioned reinforcement and operant conditioning [42]. Definition 1 parallels the innate learning process *via* conditioned response [42], in that through ego individuals train their expectations based on past *outcomes* rather than intrinsic considerations. Driving this point home, studies of accidental reinforcement on so-called 'superstitious behavior' [43] (the occurence of conditioned reinforcement randomly or spuriously) show – mirroring 1 – that a reinforcing outcome need not be *logical* in order to modify behavior. Thus operant conditioning theory lends support to the most prominent aspect of Definition 1: namely, we have evolved to *set our goals and expectations based on observing outcomes*, rather than on a full cognitive understanding of how our behaviors produce the desired outcomes.

Likewise, in evolutionary psychology [7, 6], learning is considered an intermediary between "nature" and "nurture." That is, one learns from social and other cues in one's proximate environment, but learning is enabled by an adaptive predisposition to such cues. Thus, Def. 1 reflects features, manifested in both operant conditioning and evolutionary psychology, of an innate self-interest instinct, coupled with pliancy in the criteria defining success and the parameters of how to achieve it. I note also that this brief sketch has been fleshed out in rich detail by Gilbert [8]. The "bullying self" described there may be understood in our context as an attempt to bridge the gap between one's inner self and others, or more broadly between inner expectations and extrinsic life outcomes (see Sec. 4).

The interpretation of ego as a strong adaptive instinct is useful, but surely has limits. Egoistic and ego-driven behavior, particularly when over-inflated, may also carry drawbacks for both the individual and the species [14]. Specifically, protecting the ego typically may prevent many from taking risks, which interpreted broadly could include sharing possessions of value, being more emotionally open and vulnerable with others, and living more dynamic and full lives. At the individual level, the ego is difficult to satiate and trying to do so can incur real costs (sometimes very heavy ones). Societally, people who would otherwise be generous or altruistic may be motivated instead to greed to protect their egos, especially when in combination with prisoner's dilemmas or the perception of competition [44].

3.2 Ego as a by-product of evolution

Even to the extent that ego as defined by 1 may be a universal characteristic, it need not always be adaptive. I propose that ego may also be understood as a non-adaptive psychological *response* to the pressures of evolution, and, more generally, of risk (particularly the risk of death).

Accordingly with Hypothesis 2, a human's ego-

driven fear is, perhaps, that others are fitter in the evolutionary sense. A more sophisticated perspective on Hypothesis 2 may be the following: as Tooby and Cosmides point out, most human genetic variability is adaptively neutral, and "one expects to find that heritable diversity is inversely proportional to adaptive importance" [7]. Thus, neutral genetic variability is tolerated to a great degree during evolution, but could be the raw material for adaptation when selection pressures suddenly change [7, 45]. To the extent that this fact is intuitively known to humans, Hypothesis 2 implies fear that one's genetic uniqueness or phenotypic circumstance could lead to "falling behind" in the natural selection process. Therefore, the ego fear of Hypothesis 2 could be understood as concern that one's genetic variations from the population as a whole, which are usually neutral, should prove not to be negative as civilization and technology produce accelerating adaptive pressures.

To illustrate, this might manifest as vague dread when one faces unique personal problems; as affective comfort when one judges oneself "normal;" or as smug satisfaction when one is "better off" than others [47, 48]. All of these comparisons may well be understood less as pre-emptive attacks on others than as *defensive responses* to the frightening process of natural selection, or what more poetically could be called the "human condition" [17]. And in particular, hyper-sensitive ego might be understood as an overactive response to selection pressures – due perhaps to accelerated selection pressures that may accompany increases in living standards in complex civilizations.

Paradoxically, truly unpreventable losses may be 'excused' by the egoistic thinking embodied in Hypothesis 2, whereas losses of one's own 'fault' are avoided at all costs – even if such exaggerated risk-aversion leads to irrational decision-making. Conceivably, egoistic fears might even rival the fear of death, since natural selection rewards reproductive success as opposed to longevity *per se*.

To the extent that ego is *not* adaptive, it is easier to understand how its dictates promote irrationality. Any observed over-activity of ego in contemporary human civilizations may have several proposed origins, owing to striking mismatches [7, 6] between our evolved universal tendencies and our modern, industrialized socioeconomic environment (note these are intended as explanations not of ego, but of its over-activity):

We live out of the rhythm for which we evolved. The population density of earth is much greater than during most of human evolution. Moreover, many features of modern economies, *e.g.*, agriculture, R&D, education, job markets, and factory work [16], require larger (and perhaps riskier) delays between investment and payoff compared to hunting and gathering.

Evolutionary pace has increased as a result of human civilization and technological innovation [45]. We live in a highly competitive society, with intense wealth and sociopolitical power concentration encouraging competition arguably more intense than in the environment in which we evolved [46]. Even in pre-industrial civilization, technological change could help accelerate the pace of evolution [45] and interact with culture [6].

Survival is not a direct preoccupation. Citizens of modern, developed nations possess far more wealth than throughout evolutionary history [46], and their survival faces relatively few risks. Exceptions include diseases, wars and catastrophes (which might therefore interact with ego especially strongly). At the same time, wealth depends on a complex economy over which individuals exert little control.

3.3 Discussion

I do not attempt to rank the relative importance of these two mechanisms, but I suspect that both are likely present to some degree. First, for the case of ego as an adaptation, it is very reasonable that evolution has produced some form of adaptation to guard one's self-interest. Any such adaptation will probably bear at least some resemblance to Definition 1. Moreover, ego is observably a prominent feature of the human psyche.

At the same time, I conjecture that ego as a non-adaptive by-product should also be a substantial part of the mixture, for two reasons:

- Pure psychologically egoistic theories contradict observations of altruistic behavior [1, 13] and have been argued to be sub-optimal for evolutionary success of the species [12]. It is natural that humans do not want to compete with peers and loved ones – especially close kin – for scarce resources.

- In the absence of strong evidence, it would be overly adaptationist to assume ego is part of the human psyche expressly for some definite purpose [7]. Rather, natural selection is only one factor influencing human behavior [6], and is subject to limitations and constraints such as energy. Thus, humans are imperfectly adapted to our environment and can experience pain and dissatisfaction. It is to be expected that the sometimes brutal vagaries of life in the wild induce a psychological reaction to the pressures of evolution [17].

However, note that the adaptation and by-product mechanisms for ego are mutually compatible. Consider the emotion of fear, which clearly has adaptive and maladaptive facets [49]. Analogously, even to the extent that ego as in Def. 1 is adaptive, spurring individuals to greater accomplishment, ego can simultaneously have a maladaptive side, causing irrational behavior.

A resolution to this paradox is that there is not intense selection pressure on individuals to live their highest-achieving possible lives, but rather merely to achieve satisficing reproductive success. Moreover, pursuing one's egoistic drive to achieve may have benefits, but also carries costs in terms of working hard, coping with disappointments and anxieties, etc. Thus, some amount of ego may be an adaptation encouraging achievement; but beyond some threshold level of success, many individuals may respond to ego by choosing energy-saving strategies, such as CD reduction, that could drive apparently non-adaptive behaviors.

4 Relationship to cognitive dissonance

Here, I examine the intimate relationship between the ego model and the theory of cognitive dissonance (CD) [50, 51, 52]. Virtually all aspects of this work can be understood in terms of CD, except for the evolutionary connection / motivation (although the connection of CD to evolution has been studied to a small degree [51]). In the next section I will discuss how CD results from threats to the ego, and in Sec. 4.2 examine how CD can mediate the ego's response to risks.

4.1 CD resulting from threats to ego

CD is believed by some researchers to be related to threats to one's ego or conception of self [52, 53]. Indeed, I propose that CD can result when extrinsic circumstances contradict [3] one's assessment of oneself:

Hypothesis 6 *Any variation between an individual's expectations and extrinsic outcomes can induce CD, constituting a potential threat to the ego. CD, ego, and threats may be so closely related as to function as part of the same specialized "circuit" in the sense often discussed in evolutionary psychology [6, 11].*

I note in particular that the expectations threatened in Hypothesis 6 could be those based on intrinsic or "genuine" self-esteem [20]. Thus, external events can threaten the ego whenever they contradict expectations grounded in one's self-image.

One classic method to induce CD is "unconfirmed expectations" or "effort justification," when individuals pay heavy costs to attain outcomes or results of a lower value [50]. This suggests CD could result whenever reality fails to match one's expectations – or, by extension, one's desires. This concept is intimately related with the present work because any such CD from disappointed expectations can present a potential threat to the ego. Specifically, the CD can result from a conflict between the cognition that one's ego expected a successful outcome, and the cog-

nition that the outcome failed to materialize, thereby threatening the ego.

This connection between CD, threats, and Definition 1 could also mitigate a debate between so-called "revisionists" such as Steele and Aronson, who believe that CD originates from a threat to the ego and theorists such as Festinger and Harmon-Jones, who believe CD results simply from contradictions among cognitions [53, 52, 51, 50]. In the conceptualization of Steele, CD results from behaving in a way that threatens one's beliefs of oneself. However, by Definition 1, one's ego can be threatened purely by the occurrence of disappointing or unfortunate outcomes, thus eliminating the need for a complex sense of self that complicates Steele's explanation [51]. Moreover, CD has always been understood to be a function of the importance of the conflicting cognitions, so it is highly reasonable that ego-related CD should be an important type of CD because one's self-interest is involved.

Note I do not claim that ego is always involved in CD, merely that the two are closely related, particularly for the case of CD due to unconfirmed expectations. In this case, ego may indeed be an intermediary between CD and attitude change, strengthening the motivation to reduce CD. That is, ego as I define it could highlight the connection between CD and self-interest, showing how CD can be interpreted as a vital threat, and therefore clarifying the adaptive value of CD reduction. Finallly, Harmon-Jones and others found that CD is related with the intention to act [50]. But an important aspect of Def. 1 is that ego is used to gauge future possibilities and make decisions, thus ego as in the present work may be consistent with these findings.

Gilbert [8] writes that we have evolved tendencies to exhibit behavior patterns associated with either dominant or submissive roles, which are triggered by the circumstances of our environment. It seems reasonable that the expression or supression of such innate behavioral patterns would be associated with measurable changes in the brain's activity. Thus, Harmon-Jones' measurements [50] of CD activating regions of the brain associated with the intention to act might be associated with the decision to express or suppress such innate attitudes in response to an ego change, and the subsequent associated behavior.

In the language of the ego model, we would say that the CD caused by, for instance, losing a political dispute activates a change in one's self-assessment (a blow to the ego) which subsequently affects behavior. In this scenario, behavior appropriate to one's actual position in the group may be critically adaptive, whereas opportunities to improve one's position are relatively rare. Therefore, the fact that one's genotype is distinct from phenotype (*e.g.*, one has potential to be a leader despite losing a political power struggle) would be of less relevance to evolution, so we have evolved to gauge ego based on our proximate environment.

Although from a cognitive psychology viewpoint, the difference between motivation to act and threat to the ego is important, I propose that from an evolutionary viewpoint, this distinction is less critical, since distinct yet related phenomena (e.g., ego as gauge of one's life possibilities *vs.* determination to act on those possibilities) may evolve in tandem, and have their roots deep within phylogeny. Still, if the conjecture that ego and CD are part of the same "circuit" should prove wrong, this does not disrupt the larger flow of the present work; surely CD from disappointment ought to cause both negative affect and a blow to the ego of Definition 1, doubly motivating individuals to reduce CD.

Likewise, CD may be seen as a mechanism by which unhealthy ego growth occurs, as follows. The ego functions like a protective "shell" or defense around a person's actual, vital interests.[8] This leads to an expansive definition of one's interests, and to CD whenever these perceived (but not truly vital) interests are threatened. The ego itself thus needs to be maintained and is prone to injury. Excessive ego is thus difficult to satiate, and trying to do so can incur real costs, as described previously.

[8]By the same token, Crocker and Wolfe [20] write "People will generally try to avoid the drops in self-esteem and increases in negative affect that follow from failing in domains on which self-worth has been staked." As a concrete example, losing money or a professional demotion may be understood as a vital threat, met with physiological stress responses evolved for life-threatening situations, despite the fact that the financial loss is far from a threat of imminent starvation or death.

4.2 CD mitigates ego response to risk

The key concepts of risk and uncertainty mitigate between rational choice and egoism on one hand, and a totally affect-driven, irrational model of psychology on the other. Paradoxically, Hypothesis 2 implies a pressure to measure one's genotypic value by one's phenotypic success. Yet for any given genotype, many phenotypes are possible depending on the influence of external environment, the quality of decisions made, random chance, etc., which we can collectively call *risk*:

Definition 2 *Risk can include any non-genotypic (e.g., environmental) factor that can cause significant variation in phenotypic outcomes.*

Risk creates CD between the relative safety of a default decision (and the pleasure of conserving mental energy) *vs.* the larger reward of taking a successful risk.[9] This CD can be exacerbated by a modern organized economy, which may exaggerate evolutionary pressures by disproportionately rewarding economically successful individuals. In a risky environment, rational calculation may lead to rational behavior, but any attempt to conserve mental energy by reducing CD is likely to result in *irrational* decision-making – akin to Aesop's parable of the sour grapes.

When engaging in risky or uncertain activity, any form of disappointment may cause CD, which in turn leads to doubt that one's original expectation of a positive outcome was accurate. Because we have defined ego as judging one's self-worth by extrinsic outcomes, this CD-originated doubt can extend to doubts about one's self-worth and blaming oneself for an extrinsic disappointing occurrence. Such spurious self-blame may lead to avoiding future risks in order to "protect one's ego." Thus, ego and CD can cause excessively conservative behavior, trapping people in risk-averse cycles to avoid CD and self-blame.

This sketch can be seen as an interpolation between cognitive psychology and Simon's [29] model of bounded rationality. But in the present work, unlike in bounded rationality, I emphasize that risk can be more than a small correction to the assumption of perfect information. Rather, risk includes large, persistent differences in phenotype, potentially even affecting reproductive fitness as in Hypothesis 2. And such large risks, mitigated by CD reduction, can result in the *mis*-application of heuristics to make erratic, highly irrational decisions (see Fig. 1).

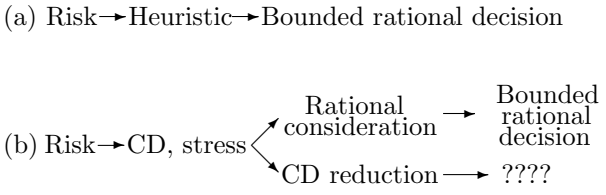

Figure 1: (a) Bounded rational decision-making. (b) In the present work, risk can still result in bounded rational decisions, but it can also result in CD reduction and irrationality.

Viewed through an evolutionary lens, ego helps safeguard individuals against risk. But an unhealthy ego can lead to oversensitive, risk-averse behavior aimed at protecting one's self-image rather than oneself. Unhealthy ego can thus adversely affect life outcomes and the ability to learn from positive and negative experiences.

4.3 Chance and the fundamental ego-CD relationship

Ultimately, ego drives CD by emphasizing fickle extrinsic success, rather than intrinsic worth. Ego as in Def. 1 is an emergent, socially constructed [20] phenomenon, reflecting social position in equal measure to abilities. Yet being grounded in phenotypic outcomes, this social construct may appear more practically relevant to life outcomes than intrinsic or "genuine" self-image (even if the latter is more accurate). This possibly cynical outlook may motivate some to chase ego-driven trappings of success, even if such pursuits are less satisfying than intrinsically-

[9] Broadly construed, this quandary is part of a classic economic tradeoff between production *vs.* consumption, "laziness" *vs.* industriousness [16].

motivated or "genuine" goals.

That is to say, success does not always follow one's intrinsic or "genuine" expectations; indeed the natural selection can occur when a previously unimportant characteristic suddenly becomes a limiting factor in evolutionary success. Thus, humans' assessments of their intrinsic worth may be deemed less relevant than their actual success, which is partly determined by luck or chance. The psychological effect of evolution may be a cult-like fixation with success that does not question how success is attained.

5 Applications

In the present section, I apply the concepts developed previously to a range of behavioral and cognitive phenomena, illustrating their predictive power and providing supporting evidence.

Of course, social scientific concepts can be multifaceted and overlapping, so I will not present the ego model as a unique or monolithic explanation of these applications. Yet the present model possesses parsimony of assumptions and applicability to this broad array of behaviors. Moreover, I claim that the ego model improves the predictive precision of explanations for these phenomena. The present work links these diverse examples by emphasizing centrality of the ego, showing that ego is not merely incidental to a variety of situations but can be a crucial element in many.

The ego model ignores our social, communal, and collective side, and should not be taken for a full behavioral theory. Still, it is argued that egoism is a deeply ingrained, and hence multifaceted and ubiquitous, instinct.

5.1 Poverty traps

Perhaps the most distressing non-adaptive behavior is any behavior that unnecessarily prolongs poverty. Recent evidence suggests that behavioral poverty traps [27] related to decision fatigue / ego depletion [15] could exist, and are perhaps responsible for propagating poverty over time [32]. Note this body of literature views individuals' economic decisions as rationally motivated, yet still makes use of behavioral economics insights to suggest ways these traps could be alleviated, including by modified behavior.

Ego could strongly interact with behavioral poverty traps. For example, we can expect poverty to have a long-term, deleterious effect on ego, saddling the disadvantaged with a need to validate their worth and abilities.[10] Such feelings of inadequacy may manifest as onerous risk-aversion, *e.g.* time-inconsistency [1, 32] or focusing on present survival to the detriment of optimally investing in a less certain future. This could even extend to human capital investment, as individuals with low ego could even consider education a risky, unproven investment.

Such behaviors have indeed been hypothesized as mechanisms of poverty traps [27] and also observed [32] as characteristic of poverty.[11] This hypothesis is further supported by empirical evidence showing high-achieving high school graduates from low-income family backgrounds typically do not even apply to selective colleges, even when financial aid would make such colleges more financially affordable to them than non-selective colleges [54].[12]

Paradoxically, then, low-income individuals appear to treat investment in their own human capital as something of an inferior good, failing to intensify their investment despite subsidies that would significantly increase their budget. Such sub-optimal investment in oneself exemplifies the overarching claim hypothesized in the Introduction, that apparently "irrational" behavior is made likely when uncertainty and risk are dominant concerns. In the present model, the mechanism mediating this is the ego, which is fundamentally risk-averse. Subsequent research into how targeted interventions can miti-

[10] This poses no major contradiction with the findings of attribution theory [28] that poverty encourages contextual self-perception, as this would be a natural way to reduce CD and protect the ego, yet the long-term attack from poverty could still be present [20].

[11] Shah and Mullainathan [32] write that whereas scarcity can engage humans to caution "too much, abundance might engage us too little."

[12] The tendency of many such students to apply to just one extremely selective college [54] may be seen as the height of ego-driven behavior because it leaves the students' human-capital investment decision utterly up to a single extrinsic college admissions event.

gate this effect further corroborates the hypothesis that uncertainty and perceived risk play a key role in application decisions. For example, Hoxby and Turner find lowering application costs and providing personally-tailored information on financial aid and graduation rates increase low-income students' likelihood to apply and graduate [55].

I hypothesize that decision fatigue may in fact play an adaptive role, limiting the number of risky decisions made. Note that the viewpoint that decision fatigue is a physiological response is entirely compatible with this evolutionary view. To support this hypothesis, consider that it is adaptive to expend much energy deliberating a decision only if it carries real risk [49, 40]. When classifying a decision as "safe," an individual automatically expends little or no energy on the decision;[13] thus decision fatigue may prevent energy waste on low-risk decisions. But fatigue also discourages making *multiple high*-risk decisions (which might potentially *interact*) whenever some decisions can be avoided, thereby lowering total risk. In a high-risk decision, a mistake in deliberation could be dangerous, thus a safe default option is to avoid the decision and maintain the status quo (loss aversion).

Hypothesis 7 *By favoring conservative behavior leading to extrinsically obvious rewards and cognitive consonance, and discouraging avoidable decisions and risks, ego may serve the adaptive function of conserving mental energy. The need to satisfy the ego may be related with an innate instinct for economic/adaptive success that is "dependable" and "safe." That is, ego may be related to an instinct for success that is maintained with minimal risk of loss, and therefore with little expenditure of mental energy or decision-making.*

Furthermore, the emphasis in Hypothesis 7 on a "safe" baseline state of wellbeing is reminiscent of the reference point in Kahneman and Tversky's prospect theory [2, 1]:

Hypothesis 8 *Ego can be identified as the reference point of prospect theory. CD is caused by negative perturbations from the reference point, and CD reduction has a goal of minimizing such perturbations while avoiding any permanent change to the reference point.*

Seen in this light, "safety" of a reference point is understandably important in human decision-making: consider that the combinatorial complexity [6] of decision-making would grow very fast with the number of interacting sub-decisions. If some sub-decisions can be considered "safe" and "settled" independently of the others, then they become non-interacting. This potentially vastly reduces the mental energy needed to make decisions, or to re-evaluate one or more sub-decisions in light of updated information. As noted in Sec. 2.4, intuitive and ego-driven decision-making may be intrinsically conservative strategies, limiting both the potential risks, and rewards, of decisions.

Finally, Hypothesis 7 brings about the further interesting possibility that rationalization is *adaptive*. I claim that *the determination of an effective rationalization is neither a haphazard process*, nor is it guaranteed to succeed. Thus, CD reduction could be an adaptation that facilitates "fast and frugal" [10] decision-making:

Hypothesis 9 *When an individual wishes to ignore the ego impact of a negative life event, engaging in successful CD reduction/rationalization helps lower the risk of ignoring this event (by providing supplementary reasons to discount the CD). This helps conserve mental energy by letting one avoid soul-searching when changing goals.*

Thus, when the fox in Aesop's fable refers to his desired grapes as 'sour,' he is justifying, not only an assertion of being better off without them, but also his *decision* not to expend further physical energy pursuing the grapes, or even further mental energy debating the act. Likewise, with reference to the discussion around Hypothesis 3, the ease by which one successfully rationalizes one's decision could reduce *decision risk* by providing secondary justification for an already-preferred, or proposed, choice. As it relates to ego, CD reduction could also reduce risk, as finding a ready explanation for previous failure makes it appear safer to try again.

[13] As an extreme example, consider the "decision" to eat store-bought food grown by strangers.

5.2 Low self-esteem

The present conceptualization of ego helps shed light on the condition of low intrinsic self-esteem. It is often assumed that low self-esteem is internalized in a global manner [63] – that one with low self-esteem is complicit in one's globally low self-assessment. However, here I propose that this condition actually comprises a *conflict* between healthy ambitions and desires for oneself, and low ego or perceived locus of control.[14] Such a combination may produce resentful anger and CD at the apparent discrepancy between one's wishes and ability to actualize them.

In this model, the individual with low self-esteem seeks extrinsic evidence validating an expectation of better life outcomes. Perceived failures can further damage the ego, making high expectations appear unrealistic. In particular, low ego protects the individual from the risk of disappointments and the risk of pursuing goals that actually are unrealistic. Yet low ego does not, in practice, mean the low-self-esteem individual lowers his/her desires and expectations. As a result, the individual can suffer from *chronic* CD from a clash between a low extrinsic ego (essentially, locus of control) and a higher intrinsic self-esteem (intrinsic expectation of positive life outcomes). Such CD, particularly if reinforced by undesired life outcomes, can engender anger and painful inner debates between risk-taking or accepting a more conservative, ego-driven status quo. Thus, some individuals may have difficulty raising self-esteem or taking life risks, as doing so is both empowering and frightening, and may entail possible further damage to the ego.

This model makes predictions potentially differing from a model of globally internalized low self-esteem. For example, the ego model may imply that low self-esteem is related with resentful feelings, an impetus to 'prove' oneself capable, etc.

The data of Zahn *et al.* on depressive patients is broadly consistent with these assertions. Zahn *et al.* found a large majority of the total sample (>80%) blaming themselves more than others, roughly half of the sample experiencing anger at either themselves or others, and roughly half of this subsample experiencing anger towards others at least as strongly as towards themselves [63]. Thus, clinical data may confirm that many patients who blame themselves nevertheless feel some generalized form of anger.

[14] I emphasize again that ego is based on one's extrinsic success, and is therefore highly sensitive to one's treatment by others, in particular to whether extrinsic consequences appear proportionate to one's decisions.

5.3 Envy

The emotion of envy is often understood [64] as simple desire for something possessed by another. However, I propose that envy is especially painful due to the involvement of CD and ego. For example, envy can result from the perception that another, who is no more deserving [47, 48] than oneself, nevertheless possesses something better. In this model, the conflicting cognitions that: (i) the other is not perceived to "deserve" success; and (ii) the other is observed to attain success can trigger CD. While I am aware of little previous literature explicitly linking envy and CD, this model does find empirical support in the work of Jankowski and Takahashi [47], who observed that envy is associated with CD.

The strength of CD and negative affect associated with envy may originate from a fear of being outcompeted in the evolutionary "race," as discussed in Sections 2.2 and 3 above. Envy may thus serve an evolutionary purpose by encouraging one to compete, thereby serving as a check on one's competitors' insufficiently-deserved or insufficiently-earned dominance.

If ego, CD, and the sensation of threat are indeed part of a single "circuit" as proposed in Hypothesis 6, then the present model clarifies a link between envy and jealousy, which is defined as envy together with fear of loss [48, 65, 64]. Although psychological literature sometimes distinguishes these concepts, some studies explicitly link the two emotions [48], and Stearns speculates that contemporary usage of the term "jealousy" for both may show speakers "viewed certain expectations as such an intimate part of their person that another's achievement provoked a sense of threat or loss" [64]. Indeed the present work corroborates this link, and adds that, in both cases, CD precipitates the sensation of threat. Further, follow-

ing the prospect theory interpretation in Hypothesis 8, either a real circumstance or a strong expectation may be incorporated into an individual's reference point, and taken for granted to save energy.[15] Then disappointment *vis-a-vis* a strongly-held expectation could provoke strong feelings of loss, and threats to ego, just as would an actual change in circumstance.

Another particularly painful form of envy is the CD associated with observing another to possess something one desires, but believes unattainable. For example, person A lives in a corrupt society and after failing in business concludes it is impossible for an honest person to "get ahead." Person A then observes acquaintance B to attain professional and financial success. A experiences CD because B is perceived to be "no better" than A [47, 48]. A reduces this CD by conjecturing that the acquaintance has succeeded through bribery or cheating.

However, A cannot feel real relief from envy because reducing CD may cause A to ignore an opportunity to learn from B's path to success, thus hurting A materially. A is caught in a complex array of emotions, including wishing B to fail in order to reduce A's own CD, and simultaneously wishing to emulate B's success. These emotions have a complex interaction with A's ego because CD reduction helps protect A's ego, whereas emulating B's success improves A's material situation, thus satisfying A's ego more deeply. Based on incomplete information, A has trouble deciding which of these strategies (CD reduction *vs.* learning) to follow.

Sub-optimal, irrational, or unpredictable behavior can result, as in Fig. 1. This example of envy illustrates well the interplay between the rational and irrational sides in human psychology because imperfect information renders it expensive and risky to determine an optimal course of behavior. Viewed more broadly, the dilemma between accounting for B's extrinsic success as mere luck (CD reduction) *vs.* as earned (egoism as in Def. 1) drives irrational behavior in the name of rational goals and pursuits.

[15] In the case of envy, the expectation may be *based on* a strongly-held self-image, whereas for jealousy, one's circumstances may form the basis *for* one's ego. But in both cases, ego is contingent on the particular extrinsic outcome.

5.4 "Animal spirits"

Much of this work has been devoted to studying how economics can affect individual psychology, via the ego. Sec. 5.1 discussed how low ego can cause individuals to under-invest in education or choose less ambitious career paths, which can potentially cost the economy as a whole. Here I attempt to explore further ways the egos of individuals can influence larger-scale economic activity in a society.

In Definition 1, the ego mediates between a person's outcomes and subsequent behavior; but for the study of large populations, it is useful to model the ego dynamic more simply. That is, ignoring detailed inner debates of one's ego, Def. 1 is basically an extrapolation where one's past "performance" sets one's expectations for the future. Arguably, it is not coincidental that this is a dynamic similar to those of financial and stock markets – which John Maynard Keynes famously referred to as "animal spirits" [56].

It is well-documented that the affective system reacts to risks according to mental images of outcomes, with little dependence on the outcome probability [49]. I hypothesize that the resulting over-sensitivity at the individual level can cause, at the aggregate level, volatility in financial markets and fluctuations in the economy as a whole [56]. Thus, both financial markets and the ego's self-assessment alike may overreact to new events, positive or negative.

The ego model may also illuminate the differing behavior of real (inflation-adjusted) and nominal (measured monetarily) variables in the economy. Despite this work's overarching concern with economic risk, thus far I have deliberately focused on real variables, which are more palpable and thus more familiar to the human psyche. Compared with a more highly abstract nominal investment (e.g., a stock, financial instrument, or derivative), I hypothesize that investing in the real economy *appears riskier* to an egoistic actor because it involves more visible consequences. Moreover, virtually all endeavors in the real economy depend on trade with others and on labor, and thus crucially require the investor to *trust* other parties [40, 57, 44].

Yet the ego arguably discourages trust, given its emphasis on the self, competition, and risk-aversion

[44]. As a result, the ego model may predict that real economy decisions are characterized by underinvestment, especially in human capital [58] and in creative [59] or highly innovative, uncertain [60] sectors. As discussed in Sec. 2.3, rational choice can break down when the ego motive, and associated risks, become too large. Even attempting a real-economy investment may seem futile if one believes success to be limited by one's own abilities (as discussed in Sec. 5.1), or by the abilities, reliability [16], or trustworthiness of one's agent. Thus in the ego model, trust problems could exert a depressive pressure on aggregate supply [61] or real economic investment.

By contrast, a nominal investment is more liquid, therefore not explicitly demanding *trust*. That is, the investor may exit the investment at any time if a desired outcome fails to materialize.[16] The purely financial investment may likewise insulate the investor from any real-economy impact of the investment decisions. Yet the nominal investment can still interact strongly with the ego because it can produce profits and losses. Thus arguably, in the nominal economy, the ego effects of distrust and (real) risk are attenuated, while the ego effects of gain and potential consumption are strongly present. Therefore, the ego model may predict that nominal economy decisions are more susceptible to speculative *over*-investment [62].

Thus, ego may *discourage* investment in training and in creative but uncertain ideas, yet *encourage* speculation, at least in some cases, in the nominal economy. Historical evidence that investors prefer bonds to stocks [1] might possibly lend support to this hypothesis.

5.5 Status symbols *vs.* costly signals

Status symbols may often be assumed to signal wealth and success. But it is interesting to consider that status symbols often are not truly costly signals. For example, many luxury goods or designer apparel items are in fact marketed at middle class consumers [66]. Furthermore, it is common to spend disproportionately on status symbols to *appear* rich without being [66], and luxury marketers realize this. In fact, such a practice must be common enough that not all status symbols truly serve as falsifiable signals of wealth (or evolutionary fitness). Instead, symbols may be more closely related with so-called advertising "puffery;" that is, it is generally expected that *all* individuals will loudly proclaim their fitness.

These considerations are of interest to the present work because they demonstrate the principle of Def. 1 that egoistic evidence is extrinsic, rather than deep. In social interactions such as flirtation, designer logos and even imitations thereof attest to the fitness of their wearer, recalling the assertion in Sec. 2.1 that ego particularly depends on sensory evidence. Even in the case of truly costly status symbols, the emphasis is on extrinsic symbols of fitness that attract others, rather than deep demonstrations of one's intrinsic qualities and abilities.

5.6 Life stages

If human desires can be reliably predicted by evolutionary considerations [8], one may presume that an intense ego-driven desire of children is to grow to adulthood, whereas that of adolescents is to procreate. Thus we can expect the ego to reflect varying motivations at different stages of life. For example, childish fears of monsters could underscore a child's greater vulnerability before reaching full maturity.

This is perhaps well-illustrated by a passage from Proust's novel *Swann's Way*, where the narrator Marcel recalls his pre-adolescence, during the first season when he is allowed to go for a walk unsupervised. His "exhilaration ... derived from being alone" can be understood as excitement at being nearly mature.

> For at that time everything which was not myself, the earth and the creatures upon it, seemed to me ... more important, endowed with a more real existence than they appear to full-grown men.

The "importance" referred to is a good example of Def. 1: any "creature" that has survived to adulthood

[16] The nominal investor also has the opportunity to invest in smaller, more affordable increments, which further encourages investment. However, I doubt that this fact alone can explain speculative *over*-investment in the nominal economy.

is "important" by virtue of being successful. At the cusp of adolescence, Marcel conflates his desire for maturity (to become like the "important creatures" upon "the earth") with a desire for reproduction:

> I had a desire for a peasant-girl from Méséglise, ... for a fisher-girl from Balbec, just as I had a desire for Balbec and Méséglise.

Such intense feelings are typical of the life stage in which they occur, and may appear less dramatic when recalled later in life. For example, adults looking back on childhood anxieties often find them "cute" or "quaint," even taking pleasure in remembering the fears. Such nostalgia can be interpreted as joy from realizing that former worries were unfounded, yet also exemplifies the contingency of ego. In fact the earlier fear could even have some adaptive function [6, 49].

At more advanced stages of life, individuals may feel fear of death, for example manifesting as a mid-life or late-life crisis. The present model predicts that such mortality fear should interact especially strongly with ego and self-image; for example a mid-life crisis may be characterized by a desire to achieve more, and to advertise one's "fitness" by increased consumption. Such a connection between fears of mortality and self-image is made easier to understand by Def. 1, which elucidates that self-image is fundamentally related to our instincts to survive and reproduce successfully.

5.7 Learning

As discussed above, envy can prevent one from learning to emulate another person's success, even if to do so would be adaptive/rational. Broadly speaking, attempts at self-improvement can be sabotaged by one's ego, since ego may emphasize competitive rather than cooperative impulses. As such, the ego may be threatened by the idea of needing to learn from others; by Hypothesis 2, this may be taken to imply that one is less fit than those from whom one must learn. Moreover, it is difficult to learn to solve a problem affecting one's life, if one's ego prevents one from acknowledging the problem in the first place.

However, such ego-driven CD is likely an overreaction. Of course, acknowledging another to be more successful in a specific domain, or even in general, does not prove the other to have a fitter genotype. On the contrary, the opportunity to learn from the other may demonstrate, in fact, that one is capable of emulating the other's success.

Thus, ironically enough, such CD can occur precisely when one *could* have learned the lesson on one's own, but was impeded by emotional issues which may themselves interact with the ego. As in the case of envy, the ego may overreact precisely when one observes others *who are no intrinsically better than oneself* enjoying better outcomes in life. The CD caused by such observations can be painful until it is either resolved by emulating the others' outcomes, or reduced by explaining (or excusing) the discrepancy to oneself.

5.8 Clinical and practical implications: What is ego health?

We have seen throughout this work two broad ways of coping with ego: egoistic competition that seeks to satiate the ego, and CD reduction functioning to *protect* the ego from threats. Yet neither of these is, generally speaking, a consistently optimal approach in life. Indeed, egoism can lead to risk-aversion and the substitution of the trappings of success for truly satisfying experiences. CD reduction, by contrast, encourages acceptance of the *status quo* – resulting at times in under-investment in one's human capital and reactive, rather than pro-active attitude towards threats and opportunities. Paradoxically, it appears that either feeding *or* protecting the ego discourage dynamic personal growth. A healthier psychological framework, then, may be acknowledging the pressures of Definition 1, yet avoiding letting one's life possibilites be limited by them.

6 Conclusions

I have proposed a model of the ego as a powerful instinct that is both evolutionary adaptation and by-product. This model is useful for exploring the inter-

action of individuals' inner desires and expectations with objective reality.

The ego model may help interpolate between rational choice theory and cognitive psychology. Indeed, the model shares rational choice theory's virtues of simple, parsimonious assumptions and relatively robust conclusions, while also incorporating many important psychological concepts such as CD, operant conditioning, ego depletion, etc. I have demonstrated how the ego model can consistently apply to a variety of personal, social, and economic phenomena, including envy, low self-esteem, nationalism, poverty traps, life stages, and learning.

The rationality debate among rational choice theorists, adaptationists, behavioral economists, psychologists, and sociologists can at times appear protracted. This work seeks to bridge the gap by demonstrating how apparently complex and irrational behaviors can be analyzed in terms of very fundamental survival (evolution-related) concerns. And conversely, rational considerations can lead to complicated tradeoff choices and a layered spectrum of behavior, much of which can be understood in a precise way from relatively simple hypotheses.

Regarding the ego model's implications for the rationality debate, a concluding thought to distill from this work: If all humans had the same genotype, behavior would be driven by a desire simply to maximize phenotypic outcomes, without competitive terror of the type referenced in Hypothesis 2. Conversely, if genotype completely determined phenotypic outcomes, humans would only need to be concerned with optimizing the genotypes of their offspring. But in reality, there is a more complex interplay between genotype and phenotype, wherein genotype can offer uncertain and situation-dependent advantages towards improving phenotypic outcomes, and wherein phenotypic outcomes frequently serve as a proxy indicator of genotypic fitness. In this complex world, egoistic and ego-driven behavior can result.

References

[1] S. DellaVigna, *J. Econ. Lit.*, **47** 315 (2009).

[2] D. Kahneman, Nobel lecture (2002).

[3] M. Zafirowski, *Soc. Sci. Inform.*, **40**, 195 (2001).

[4] G. J. Stigler and G. S. Becker, *Amer. Econ. Rev.*, **67**, 76 (1977). G. S. Becker, *The Economic Approach to Human Behavior*, University of Chicago Press (1976).

[5] M. Hechter and S. Kanazawa, *Ann. Rev. Sociol.*, **23**, 191 (1997). J. Goldthorpe, *Brit. J. Sociol.*, **49**, 167 (1998).

[6] Jaime C. Confer, Judith A. Easton, Diana S. Fleischman, Cari D. Goetz, David M. G. Lewis, Carin Perilloux, and David M. Buss, *Amer. Psych.* **65**, 110 (2010).

[7] J. Tooby and L. Cosmides, *J. Personality* **58** 1 (1990).

[8] P. Gilbert, *J. Cog. Psychother.: Int. Quarterly*, **16**, 263 (2002).

[9] J. R. Anderson, *The Adaptive Character of Thought*, Erlbaum (1990).

[10] K. E. Stanovich, R. F. West, *Behav. Brain Sci.* **23**, 645 (2000) ; V. M. Chase, R. Hertwig and G. Gigerenzer, *Trends Cog. Sci.* **2**, (1998).

[11] L. Cosmides and J. Tooby, *Amer. Econ. Rev.*, **84**, 327 (1994).

[12] E. Sober, in J. E. Fenstad *et al.*, eds., *Logic, Methodology and Philosophy of Science VIII* 495. Elsevier Science Publishers (1989).

[13] A. W. Schulz, *Studies Hist. Philos. Biol. Biomed. Sci.* **56**, 15 (2016).

[14] M. Humphreys, *Economics and violent conflict* Unicef (2003). T. Homer-Dixon, *Internat. Security*, **19**, 5 (1994). G. K. Brown and F. Stewart, Oxford University Centre for Research on Inequality, Human Security and Ethnicity (CRISE) Working Paper No. 81 (2015).

[15] R. F. Baumeister, *Persp. Psych. Sci.*, **3** 14 (2008); R. F. Baumeister, K. D. Vohs and D. M. Tice, *Current Dir. Psych. Sci.*, **16** 351 (2007).

[16] S. Kaur, M. Kremer, and S. Mullainathan, *Amer. Econ. Rev.*, **100** 624 (2010).

[17] T. Pyszczynski, J. Greenberg, S. Solomon, Jamie Arndt, and Jeff Schimel, *Psychological Bulletin* **130**, 435 (2004).

[18] Pyszczynski, T., and Greenberg, J. (1987). In L. Berkowitz (Ed.), *Advances exper. soc. psychol.* **20**, 297. San Diego, CA: Academic Press.

[19] M. L. Snyder, W. Stephan, and D. Rosenfield, *J. Personality Soc. Psychol.* **33**, 435 (1976). W. G. Stephan and P. M. Gollwitzer, (1981). *J. Exp. Soc. Psychol.*, **17**, 443.

[20] J. Crocker and C. T. Wolfe, *Psychol. Rev.* **108**, 593 (2001).

[21] D. R. Kille and J. V. Wood, in *Encyclopedia of Human Behavior*, 321 (2012).

[22] M. R. Leary, E. S. Tambor, S. K. Terdal, and D. L. Downs,*J. Personality Soc. Psychol.*, **68**, 518 (1995).

[23] C. Townsend and S. Sood, *J. Consumer Research*, **39**, 415 (2012); S. I. Rick, B. Pereira, K. A. Burson, *J. Consumer Psychology*, (2013).

[24] R. A. Peterson, *Poetics* **25**, 75 (1997).

[25] http://en.wikiquote.org/wiki/Napoleon_I_of_France

[26] D. Kahneman, *Behav. Brain Sci.* **4**, 339 (1981).

[27] M. R. Carter and C. B. Barrett, *J. Dev. Studies*, 42, 178 (2006); C. Berti Ceroni, *Economica*, **68**, 203 (2001); A. Kraay and D. McKenzie, *J. Econ. Persp.*, **28**, 127 (2014); E. Duflo, M. Kremer and J. Robinson, *Amer. Econ. Rev.*, **101**, 2350 (2011).

[28] M. W. Kraus, P. K. Piff, and D. Keltner, *J. Pers. Soc. Psychol.*, **97** 992 (2009); M. W. Kraus, S. Côté, and D. Keltner, *Psychol. Sci.*, **21** 1716 (2010); M. W. Kraus, P. K. Piff, R. Mendoza-Denton, M. L. Rheinschmidt, and D. Keltner, *Psychol. Rev.*, **119** 546 (2012).

[29] H. A. Simon, in C. B. McGuire and R. Radner, eds., *Decision and Organization*, Amsterdam: North-Holland Publishing Company (1972). H. A. Simon, *Psychol. Rev.*, **63**, 129 (1956).

[30] H. W. Kelley, *Amer. Psychol.*, **28** 107 (1973).

[31] S. Wouters, B. Duriez, K. Luyckx, T. Klimstra, H. Colpin, B. Soenens, K. Verschueren, *J. Res. Personality* **47**, 356 (2013).

[32] A. V. Banerjee and S. Mullainathan, *Amer. Econ. Rev.*, **98**, 489 (2008); A. J. Shah, S. Mullainathan, and E. Shafir, *Science*, **338**, 682 (2012).

[33] M. J. Lerner and D. T. Miller, *Psychological Bulletin* **85**, 1030 (1978).

[34] D. Muchlinski and D. S. Siroky, in E. Kavalski (Ed.), *Encounters with World Affairs: An Introduction to International Relations*, Ashgate, 295-310 (2015). J. J. Mearsheimer, Yale Workshop on International Relations, (2011). http://mearsheimer.uchicago.edu/pdfs/kissingcousins.pdf

[35] N. Daniels, *Philos. Pub. Affairs*, **7**, 206 (1978).

[36] F. Caselli and N. Gennaioli, *J. Eur. Econ. Assoc.*, **3**, 679 (2005).

[37] C. Panayotakis, *Amer. J. Econ. Sociol.*, **73**, 126 (2014).

[38] S. Kunovich and K. M. Slomczynski, *Eur. Soc. Rev.*, **23**, 649 (2007).

[39] E. Herrigel, *Zen in the art of archery*, Vintage Books (1989).

[40] P. Slovic, *Risk Analysis* **24**, 311 (2004). P. Slovic, *Risk Analysis* **19**, 689 (1999).

[41] J. E. R. Statton and D. T. Cerutti, *Annu. Rev. Psychol.*, **54** 115 (2003).

[42] B. F. Skinner, *Science* **213**, 501 (1981); B. F. Skinner, *J. Exp. Analysis Behavr.* **41**, 217 (1984).

[43] C. M. Bloom, J. Venard, M. Harden, and S. Seetharaman, *Behav. Process.* **75**, 8 (2007). P. Weisberg and D. B. Kennedy, *J. Exp. Child Psychol.*, **8**, 222 (1969).

[44] T. H. Chiles and J. F. McMackin, *Acad. Management Rev.* **21**, 73 (1996).

[45] J. Hawks, E. T. Wang, G. M. Cochran, H. C. Harpending, and R. K. Moyzis, *Proc. Nat. Acad. Sci.* **104**, 20753 (2007).

[46] M. Sahlins, The original affluent society, in *Stone age economics* (1972).

[47] K. F. Jankowski and H. Takahashi, *Psych. Clinical Neurosci.* **68**, 319 (2014). H. Takahashi, M. Kato, M. Matsuura, D. Mobbs, T. Suhara, Y. Okubo, *Science* **323**, 937 (2009).

[48] P. Salovey and J. Rodin, *J. Pers. Soc. Psychol.* **47**, 780 (1984).

[49] G. F. Loewenstein, E. U. Weber, C. K. Hsee, and N. Welch, *Psychol. Bulletin*, **127**, 267 (2001). A. Monat, J. R. Averill, and R. S. Lazarus, *J. Pers. Soc. Psychol.* **24**, 237 (1972).

[50] M.-A. Martinie, L. Milland and T. Olive, *Soc. Pers. Psychol. Compass* **7/9** 680 (2013); Harmon-Jones E, Amodio DM, and Harmon-Jones C (2009). In: Zanna MP (ed.) *Advances in Experimental Social Psychology*, vol. 41, pp. 119166. San Diego, CA: Academic Press; E. Harmon-Jones and J. Mills (1999) *Cognitive Dissonance: Progress on a Pivotal Theory in Social Psychology.* Washington, DC: American Psychological Association.

[51] L. C. Egan, L. R. Santos and P. Bloom, *Psychol. Sci.*, **18**, 978 (2007).

[52] G. A. Akerlof and W. T. Dickens, *Am. Econ. Rev.*, **72** 307 (1982).

[53] C. M. Steele and T. J. Liu, *J. Personality Soc. Psychol.*, **45**, 5 (1983).

[54] C. Hoxby and C. Avery, *Brookings Papers Econ. Act.* (Spring 2013).

[55] C. Hoxby and S. Turner, *Educ. Next* (Fall 2013). C. Hoxby and S. Turner, *Amer. Econ. Rev.*, **105**, 514 (2015).

[56] P. De Grauwe, *Econ. Theory*, **47**, 423 (2011). R. E. A. Farmer, *Econ. J.*, **122**, 155 (2012). P. Howitt and R. P. McAfee, *Amer. Econ. Rev.*, **82**, 493 (1992).

[57] G. A. Akerlof, *Quarterly J. Econ.* **84**, 488 (1970).

[58] D. Acemoglu and J.-S. Pischke, *Econ. J.*, **109**, F112 (1999).

[59] S. Cunningham, T. Cutler, G. Hearn, M. Ryan, and M. Keane, *Media International Australia* **112** 174 (2004). W. D. Walls, *J. Cultural Econ.*, **29**, 177 (2005).

[60] R. Henderson, *RAND J. Econ.*, **24**, 248 (1993). B. H. Hall, *Oxford Rev. Econ. Policy*, **18**, 35 (2002).

[61] M. Magill and M. Quinzii, *J. Mathematical Econ.* **44**, 785 (2008).

[62] J. N. Devine, *Rev. Rad. Pol. Econ.*, **15**, 1 (1983).

[63] R. Zahn, K. E. Lythe, J. A. Gethin, S. Green, J. F. W. Deakin, A. H. Young, and J. Moll, *J. Affective Disord.* **186**, 337 (2015).

[64] P. N. Stearns, in *Encyclopedia of Human Behavior*, 479 (2012).

[65] D. M. Buss, and M. G. Haselton, *Trends Cog. Sci.*, **9**, 506 (2005). D. M. Buss, R. J. Larsen, and D, Westen, *Psychol. Sci.*, **3**, 251 (1992).

[66] E. Granot, L. T. M. Russell, and T. G. Brashear-Alejandro, *J. Market. Theo. Pract.* **21**, 31 (2013); L. M. Pepall, D. J. Richards, *J. Bus.* **75**, 535 (2002).

[67] J. T. McGuire, J. W. Kable, *Psychol Rev.* **120**, 395 (2013); *Cognition* **124**, 216 (2012).