

# Money as MacGuffin: A Factor in Gambling and Other Process Addictions

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I have added a synopsis for the reader’s convenience. Most of the cited works that are under my control can be downloaded from [www.picoeconomics.org](http://www.picoeconomics.org).

## **Synopsis**

The study of addiction has become increasingly complicated with the recognition of many “process” addictions, which do not involve a psychoactive agent to fool the brain into generating reward. The prototype is gambling on games of pure chance—from craps to lotteries—the expectable outcome of which is a net loss of the money that is supposed to be their object. I argue here that such gambling has a reward-maximizing rationale, derived from an incompatibility between two long term strategies: for consuming rewards and refreshing appetite for them. I further propose that this incompatibility is not the competition of substitutable alternatives, but rather results from a local incommensurability that keeps the strategies from being directly weighed against each other, even though the ultimate selective factor is the same in both cases.

This explanation requires hypotheses about an area of human economy that has eluded systematic study, and perhaps for that reason has not been recognized by conventional utility theory, even to the extent of being a blank *terra incognita*. This is the area of self-generated reward that could be called emotional, or, better, endogenous—that reward which does not strictly depend on events outside of the mind, or on the promise of such events. Since the rewardingness of a process is its power to select behaviors that have preceded it, the concept of reward that can be generated mentally seems contradictory—How can you be in control of the factor that controls you? Resolving this apparent contradiction even hypothetically, which is all I promise here, requires us to imagine the consequences of discounting prospective reward in a hyperbolic curve as a function of delay.

Hyperbolic discounting itself has firm empirical roots, and there is reason to be sure of at least one of its implications, intertemporal bargaining based on recursive self-prediction, which fits common descriptions of both the strength and freedom of will. I summarize this topic and explore what it implies for self-generated reward, a major but largely unexplored human motive: If the rewarding power of imagination is at your arbitrary disposal, it must be limited by some factors that are outside your control, an obvious one of which is the relevant appetite. Otherwise endogenous reward could be a circular process that perpetuates itself. If we combine the enabling effect of appetite on reward with a consequence of hyperbolic discounting-- that proximity heightens reward disproportionately-- we can predict an incentive to restrict premature consumption, and thus build appetite, by using adequately rare occasions as cues for consumption. Since success in instrumental tasks—those not undertaken for their own sake—can often provide such occasions, these tasks may come to be valued for their own sake (*hedonically*) as well as for their instrumental purpose. Hedonic motives may come in effect to parasitize an instrumental task, and even reduce it to an excuse for the hedonic task. Such an excuse can be called a MacGuffin.

Tasks that are efficient at pacing rewards to optimize appetite are apt to be inefficient in getting their ostensible goals, success at which increasingly cuts suspense short. This is particularly true of self-generated reward, anticipation of which represents consumption of the reward in itself; so occasions that pace this reward need to be both adequately rare and adequately surprising. Since the intertemporal bargaining that creates willpower tends to make goal-seeking more systematic, and hence both efficient and predictable, motives to refresh appetite will often contradict motives that support intertemporal bargaining solutions. Both kinds may be long term motives, but they cannot be simply weighed against one another, because legitimizing appetite as a goal would often belie the ostensibly instrumental purpose of the activity. In situations where loss of the instrumental goal can also be an investment in appetite, objectively poor risks may be good hedonic options-- but only to the extent that the person interprets these risks as instrumentally necessary. The result is addictive choices that are disguised to a variable extent as productive activities, the exemplar of which is problem gambling.

## Text

Alfred Hitchcock’s genius was in his timing. The experience he sold, which for years he produced better than any competitor, was suspense. His characters were always chasing something, but for Hitchcock this something was arbitrary—what he called a MacGuffin. The uranium being stashed away in *Notorious* could just as well have been diamonds or hidden evidence or a toxic virus, and the emotional arc of the movie would have been the same. The MacGuffin was a necessary but nonspecific component of the suspense. The management of this suspense was what required timing, the crescendo of threats and reprieves as the protagonists approached their goal, culminating in an exhilarating climax. At that point the MacGuffin had become unnecessary. Other directors have often thrown it away at the end—the treasure of the Sierra Madre, the diamond-studded necklace in *Titanic*—like a female impersonator tossing off his wig. The crucial question for us, though, is why it was valuable to begin with.

This conference is about addiction, a problem that is perhaps the greatest challenge to our confidence in human rationality. The problem of addiction is not confined to a few seductive molecules. Addictive preferences are woven deeply into the fabric of civilized life, including those for normal substances (food, chocolate), structured activities that do not require a substance (gambling, day trading), emotional patterns (thrill seeking, destructive personal relationships), and the most elementary and pervasive form of regretted choice, procrastination (Andreou & White, 2010). There have been many attempts to formulate a technical definition of addiction, but the results never coincide exactly with ordinary usage. For instance, the emergence of physiological signs of withdrawal has been a favorite of authors who want to restrict “addiction” to the realm of substance use, but discontinuing even heavy use of cocaine does not lead to physiological withdrawal, whereas stopping intense gambling activity sometimes does (Blaszczynski et al., 2008). We do not have to settle on the proper definition. The challenge to rationality is the same whether someone has an addiction or just a bad habit, as long as the person herself perceives the habit to be both bad and hard to break.

In rational choice theory (RCT) an individual maximizes expected future utility according to an exponential discount curve,

$$\text{Present value} = \text{Value}_0 \times \delta^{\text{Delay}} \quad \text{Formula 1}$$

where  $\text{Value}_0$  = value if immediate and  $\delta = (1 - \text{discount rate})$ .

The obvious question that addiction poses RCT is, what motivates someone to repeatedly choose what she herself often sees as a poorer option, even if she is trying to stop choosing it? Furthermore, when someone is seduced by a fudge sundae or cocaine high, she chooses immediate consumption in one modality despite larger, later losses in others—health, wealth, safety. The problem gambler seeks wealth despite the likelihood of actually losing this same wealth. Thus, the present discussion must address a second question as well: What is there in this internally inconsistent proposition that seduces the gambler?

A night at the casino has something of the structure of a suspense film. You make repeated small plays, winning a little or losing a little, but building up a sum for the evening that will be either a win or a loss. There is as much lore in the gambling industry as there is in the film industry on how to pace the bets and structure the risks. Certainly the optimal patterns differ. Unlike the invariant win in a Hitchcock movie, the odds favor an overall loss at the casino. But our second question arises in both fields: How does the threat of loss generate value, in such a way that the prospective combination of loss and restoration is worth more than the prospect of staying secure? The question has relevance beyond the confines of fiction and gambling, but they provide simplified examples, stripped of noncontributory properties.

Suspense fiction is a modality of reward that does not depend on money or the things that money can buy. A similar modality, thrill born of suspense, is well recognized as what adds the value needed to make gambling a winning hedonic activity. But this phenomenon raises a third, more unsettling question: When our physical senses are not involved, where does our reward come from? That is, when we do not need to obtain a specific turnkey to unlock our reward process, what do we need? The conventional answer is that we are rewarded by the prospect of getting physical rewards at some time in the future—that when we seek money or power or reputation, they are just tokens backed by the promise of physical rewards. It is obvious that such tokens come to function on their own, just as token currencies can function without being convertible to gold; but the properties of this independent rewarding power have not been explored.<sup>1</sup> Just as token currencies have specific requirements, such as a widespread expectation of being accepted, and specific vulnerabilities, such as a proneness to inflation, nonphysical reward must also have its own requirements and constraints. In recent years the discovery of mirroring centers in the brain has suggested a neural substrate for one such highly valued process, vicarious experience, but not how vicarious experience translates into reward (see [Preston & de Waal, 2002](#), and [Ainslie & Monterosso's commentary, 2002](#)). Vicarious experience is only one kind of imagination, and even that has not been explored in cases where its object is not present to at least one of the senses.

The possibility of nonphysical addictions (or addiction components) brings this ignorance into sharp focus and provides an extreme example that any theory of nonphysical reward must accommodate. I will describe how an alternative to the exponential delay discount curves of RCT permits answers to the three questions I have listed as raised by problem gambling: (1) What leads a person to temporarily prefer poorer alternatives? (2) What leads her to prefer the prospect of less to more of the same good? (3) What leads her to value goods that lack the physical capacity to induce reward? Hyperbolic discounting itself is a well-established empirical finding, and I will give only a brief summary here. The value of risk per se is best explored in light of how nonphysical rewards function, a difficult process to study experimentally but one for which hyperbolic discounting can at least clarify the components (see related discussion in [Ainslie, 2001, pp. 161–197, and 2003](#)).<sup>2</sup>

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<sup>1</sup> The internal reward process is thought of as a way of predicting the “real” rewards that have obvious adaptive usefulness. But although rewardingness evolved as a proxy for adaptiveness, within an organism the rewardingness itself is sovereign. Just as organisms can be seen as mere vehicles for passing on genes, functionally rewards are just means to stimulate the internal reward process. Occasions that excite this process without leading to adaptive goods are not false, just unattached, but therefore vulnerable to the deterioration I will be describing.

<sup>2</sup> Texts of many Ainslie references are available at [www.picoeconomics.org](http://www.picoeconomics.org).

## A Review of Hyperbolic Discounting

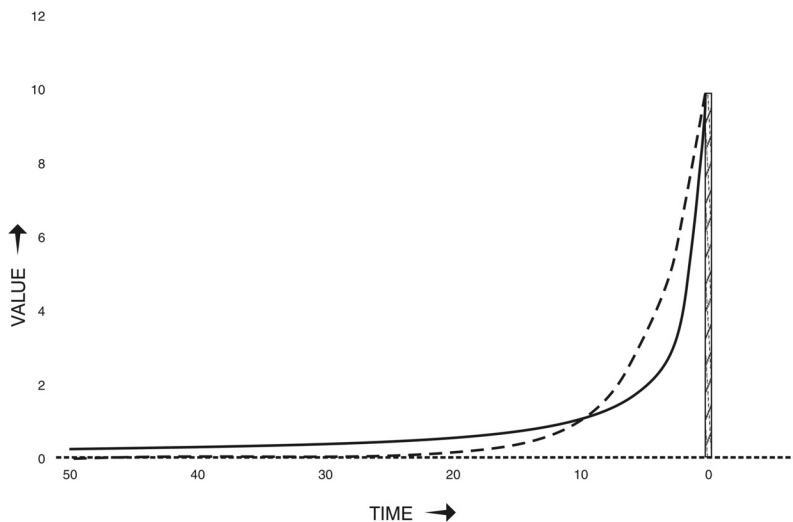
This approach originated in controlled experiments suggesting that rewards exert attraction in inverse proportion to their delays. Richard Herrnstein initially reported that nonhuman animals tend to sample two concurrent streams of reward in proportion to the mean rates, amounts, and immediacies of those rewards (the “matching law”; 1961), a pattern he later found in humans as well (1997). Application of the matching law to single (discrete, i.e., not streamed) choices between smaller sooner (SS) and larger later (LL) rewards by the current author yielded four specific predictions (Ainslie, 1975, 1992):

1. The decline in rewarding effect with delay is described better by a value function that is inversely proportional to delay (hyperbolic discount curve) than by a function that declines by a constant proportion of remaining value for each unit of delay (exponential discount curve; Figure 2.1). That is, data on the evident value of a single prospective reward at varying delays will be described better by a hyperbolic than by an exponential function of those delays. The most commonly used form of the hyperbolic curve has been

$$\text{Present value} = \text{Value}_0 / [1 + (k \times \text{Delay})] \quad \text{Formula 2}$$

where  $\text{Value}_0$  = value if immediate and  $k$  is degree of impatience (Mazur, 1987).

**Figure 1**



**Figure 1**

Exponential and hyperbolic discount curves drawn from a reward that would be worth 10 units if immediate, with slopes adjusted so that each is worth 1 unit of reward at 10 units of delay (hyperbolic  $k = 0.9$ ; exponential  $\delta = 0.794$ ). The value of the reward at any given delay is represented by the height of the curve at that point. The hyperbolic curve (solid line) is steeper at short delays, but has a higher tail.

2. Preferences between some pairs of an SS reward and an LL alternative at varying delays but with a constant lag between SS and LL rewards will favor LL rewards when both are distant, but shift to SS alternatives when they become closer.
3. During the period when an LL reward is preferred, subjects will sometimes choose behaviors whose only function is to prevent their own subsequent choice of the SS alternative.
4. Subjects choosing between a whole series of SS/LL pairs at once will have a greater tendency to choose the LL rewards than will subjects choosing between the same pairs one at a time. A subsidiary prediction is that human subjects who perceive current choices between SS and LL rewards as test cases—examples that predict their own future preferences between similar pairs of rewards—will prefer LL rewards more than they do when they see the pair of alternatives as an isolated choice. That is, people may create *bundles* of interdependent expectations by predicting their future choices *recursively* on the basis of each current choice.

Subsequent work by both economists and psychologists has largely confirmed these predictions, both in nonhuman animals and in human subjects<sup>3</sup> under conditions that do not invite calculation (Ainslie, 2007; Ainslie & Monterosso, 2003; Green & Myerson, 2004; Hofmeyr et al., 2010; Kirby, 1997; Kirby & Guastello, 2001). The first three findings suggest that our successive motivational states regularly conflict in a way that prevents durable resolution, and that we must find ways to avoid or forestall our own foreseeable temporary preferences if we want to make sure that our current preference will be followed. The fourth finding suggests a way of managing temporary preferences, which fits intuitive descriptions of both willpower and freedom of will. The gist is that a combination of imperfect self-prediction and a tendency to temporarily prefer SS rewards sets up a limited warfare relationship among successive selves, which can be resolved by discerning—or defining—a variant of repeated prisoner’s dilemma among these selves: Defection in the present case makes defection in future cases more probable, not from a motive of retaliation (which would be present in a classical repeated prisoner’s dilemma) but by making cooperation seem likely to be wasted. The stake of LL reward may be aggregated from the evident consequences of each choice, as in binges with hangovers, or may be an anticipated state, such as good health or adequate savings. The necessary element for the self-prediction process is that the person’s expectation of getting a category of LL reward as a whole is put at stake when each opportunity within a definable set of SS rewards occurs. This self-prediction process is recursive, in that each estimate of future self-control is fed back into the estimating process, thus forming part of the incentive for each choice. Our criteria for deciding which choices constitute lapses are often called *personal rules*.

I have developed this model of will elsewhere (Ainslie, 2001, 2005, 2011, 2012). Its importance for the present discussion is that efficient intertemporal bargaining entails making choices in predictable ways, that is, not surprising yourself when you can avoid it. Ironically, the mechanism that rewards this regularity is also the one that arguably makes the will free.

## Self-Control Is Only Half of Rationality

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<sup>3</sup> Most experiments now award human subjects one of their actual choices, selected randomly, but the results have been reported not to differ from studies in which subjects chose between hypothetical rewards (Madden et al., 2003).

The phenomenon of hyperbolic discounting might seem to imply that rationality consists of foreseeing your temporary preferences and forestalling them either by judicious use of Ulysses-like commitments or by making resolutions that can function as self-enforcing contracts—willpower. However, rationality as willpower leaves something out, and may create a problem in its own right—not just the “rule worshipping” of [Mintoff and others \(2004\)](#), but your systemization of your own choices, which become less hedonically satisfying as they become more regular. Hyperbolic discount functions predict this limitation as well. I will not discuss most of will’s side effects here (see [Ainslie, 2001](#), pp. 143–160), but to understand substance-free addictions, we will need to find an aspect of rationality that does not entail will as it is usually understood, and may even be spoiled by it.

In older models of motivation deprivation states had a negative valence. Circumstances imposed needs on you, and you got pleasure from reducing them. Your appetites were like steam boilers, in which pressure was aversive and your motivation was to get rid of it. You would avoid deprivation states if you could and seek to remain in a Nirvana-like calm. A little thought revealed this model to be absurd. It would mean that people should eat to avoid hunger, and that the loss of sexual libido caused by certain medicines would be a benefit rather than an unfortunate side effect. We now regard deprivation states as making appetites possible;<sup>4</sup> appetites are what make possible reward in general and satisfaction in particular.<sup>5</sup>

Historically, the dysphoria of unsatisfied appetites has been the main driving force of human behavior, but modern societies are expert at solving that problem. We are used to eating when we want, having analgesics available for pain, and being neither too hot nor too cold. Control of conception and treatment of venereal disease have greatly reduced barriers to sexual satisfaction *ad lib*. Beyond such concrete rewards there are limitless activities and relationships that now provide most of our satisfaction, and perhaps always have. We know a great deal about how to satisfy appetites. Only rarely has the converse problem come into focus: What do we do when appetites become too slight? If our appetites are not like boilers but like waves on the ocean, which we ride up to have the pleasure of coasting down, what do we do if we find ourselves becalmed?

**Reward by an abundant good is largely determined by appetite.** The problem for modern societies is that however robust our sources of satisfaction, our appetites are perishable. At the most elementary level, repeated stimulation of any sense organ leads to fatigue, a temporary decline in function. But familiar scenarios lose their power to excite even after periods of rest; this is not fatigue, but habituation, a learned anticipation that forestalls curiosity or

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<sup>4</sup> Appetite is the capacity to be rewarded in a given modality. Modalities are defined by the processes that satiate one while leaving another fresh (such as hunger versus thirst), which are modestly known in the case of physical rewards ([Herrnstein, 1977](#)) and almost unknown for endogenous rewards (see below, and [Ainslie, 1992](#), pp. 243–256).

<sup>5</sup> I use “satisfaction” as a special case of “reward,” the most general term for the mechanism that makes processes that have just happened more likely to recur. Satisfaction is reward that is subjectively desirable, which means reward that does not bring on reward-inhibiting components to form vivid but aversive experiences such as pains and negative emotions. In this usage, pain is an appetite that at the very least makes attention to it rewarding, and arguably draws us into the emotional engagement that creates aversion (“protopathic” pain; [Melzack et al., 1963](#)). Urges that are avoided when foreseen in advance could thus be thought of as *negative appetites*—itches, for instance, or the urge to panic.

suspense. From the standpoint of evolution, it is undoubtedly adaptive for intense satisfactions to fade away into habit as we get efficient at obtaining them. This process keeps us motivated to explore our environment, both when we are young and inept and when we have become master problem solvers. If our reward mechanisms operated in strict proportionality to how much of some external stimulus we could get, then a reward rate that was sufficient to shape our behavior when we were beginners would lead us to rest on our laurels once we had become adept at getting it. But instead, as we learn an activity, the reward it generates increases only at first, and then decreases again because our appetite does not build as much before it is satisfied.

The paradox is that it is just those achievements which are most solid, which work best, and which continue to work that excite and reward us least. The price of skill is the loss of the experience of value—and of the zest for living (Tomkins, 1978, p. 212).

While habituation makes our skills at getting goods more effective, it makes our attempts to enjoy these goods less effective. Here we begin to see the divergence of two kinds of effectiveness, presaging a split in rationality itself, which will figure increasingly in our discussion.

Because hyperbolic discount curves give disproportionate weight to imminent prospects, we cannot just blend appetite and satisfaction in optimal mixtures, like breathing out and breathing in. Small satisfactions that can be had immediately will outweigh delayed satisfactions that, compared from a distance, would seem worth the delay. As soon as a wave rises a little from the surface of the sea, we get an urge to coast down it. The properties of appetites are often such that rapid consumption brings an earlier peak of reward but reduces the total amount of reward that the appetite makes possible. Where we have free access to an activity that rewards more intensely the greater our appetite for it, we tend to consume it faster than we should if we were going to get the most reward over time from that appetite. Hyperbolic discounting predicts that in a conflict of satisfaction patterns between the long but delayed versus the brief but soon, an organism that discounts the future hyperbolically is primed to choose brief but soon. Similarly, if an increase in intensity can be had at the cost of duration, that increase, too, is apt to be chosen. This problem makes no sense in a world of exponential discounting. In an exponential world, an adept consumer should simply gauge what the most productive way to exploit an appetite would be, and pace her consumption accordingly. We would entertain ourselves optimally by waiting for just enough appetite and then satisfying it. By contrast, common experience teaches that a reward that we indulge in *ad lib* becomes unsatisfactory for that reason itself. To get the most out of any kind of reward, we have to have—or develop—limited access to it.

The effect of limiting access to a reward that is otherwise freely available can be modeled with a diagram. Assume for simplicity that appetite grows linearly and is exhausted linearly with consumption. The value of consumption is the summed, hyperbolically discounted value of each of its instants. If there is a factor that delays consumption from the instant at which the consumption could, if immediate, compete with available alternatives—the instant it reaches what could be called the market level of reward—that factor may substantially increase the product of [value  $\times$  duration] before the appetite satiates (Figure 2).



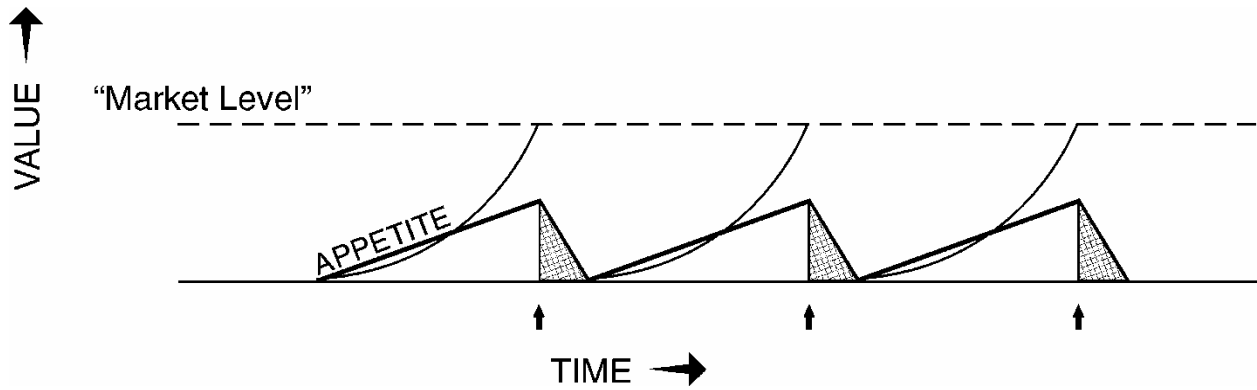


Figure 2a

A simple model of appetite, that grows in a straight line until the summed, hyperbolically discounted value of the reward from harvesting it (stippled area) reaches a competitive market level. Without a delay factor, the reward is harvested as soon as the choice is made (at arrows).

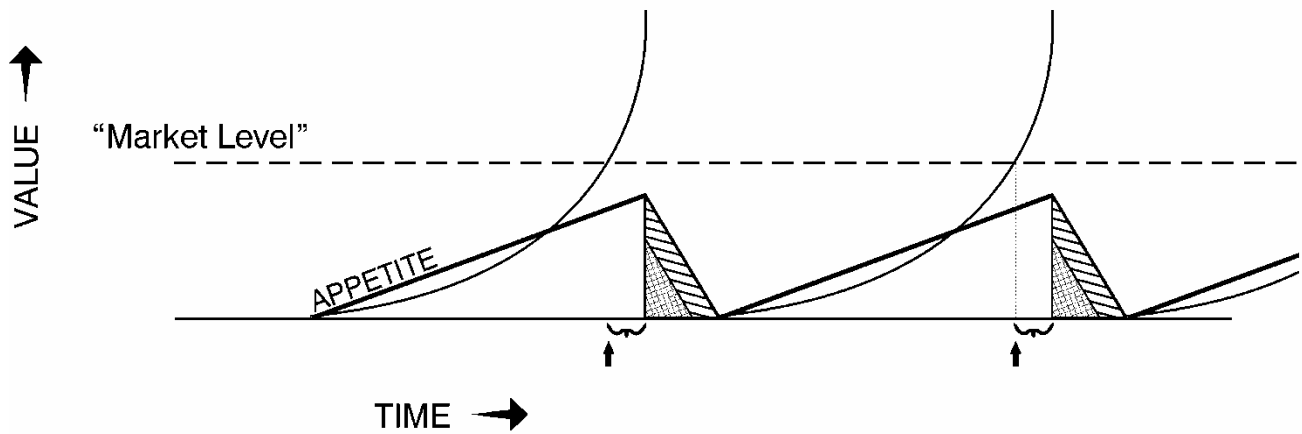


Figure 2b

Increased reward (stripes) resulting from increased appetite when there is an obligatory delay (brackets) in consumption of the reward between the instant of choice, when its discounted value rises to market level (arrows), to when the reward is consumed. The obligatory delay allows the discounted value of the reward to rise well above market level before consumption occurs.

These relationships are obvious with concrete satisfactions. For instance, spending our day with snacks at hand can lead to the pattern of eating called grazing, which may be an

efficient way to get some other task done but undermines the potential pleasure of dining. The solution is to commit ourselves to deprivations, such as a personal rule against eating between meals. A basic example of creating hedonic gain from net neutrality is the sauna—you make yourself hot for the pleasure of making yourself cold, instead of staying at room temperature and looking for satisfaction in some other activity. Examples with more punch include the threatening experiences that we expect to create exhilaration: climbing dangerous mountains (see Loewenstein, 1999), sponsoring a social event that is at risk for failing, or signing up for a grueling training rotation such as surgery in a medical internship. The privation entailed in such activities is often such that we have to commit ourselves in advance—at least in resolution—because we would otherwise not choose them on the morning when we had to set out. It may be that there is no limit to this logic, that enormous deprivations can lead to enormous gains—some religions suggest giving away all our possessions and becoming mendicants—but as the deprivation required increases, fulcrums that provide the motivational leverage necessary to accept it become increasingly hard to find. The !Kung people of the Kalahari Desert are said to have appeared unusually happy when they lived in cultural isolation under conditions of extreme deprivation, but they nevertheless chose to live squalid lives on the bottom rungs of modern civilization when that option became available (Glantz & Pearce, 1989). However, as long as consumption requires physical action, commitment is at least possible. Physical commitment is apt to be unavailable when a rewarding activity is mental.

### Among imaginative organisms most reward is endogenous

When we are free of, or have satiated, our physical deprivation states, most of the reward we seek comes from expectations we construct of the future, our rehearsal of the past, and occasions for emotion that we have in the present, which are often but not necessarily connected to physical rewards. We conjure up so much that is not in our current sensory fields that we live as if in a video game, cultivating some scenarios and trying to avoid others, able even to prevent the intrusion of physical reality in many cases, but unable to prevent the intrusion of remembered or imagined horror in other cases. Much (I would say most) satisfaction that modern people experience from goods of various kinds is actually available *ad lib*, within our psyches, and what we buy from the world is only some kind of sheet music that lets us pace it.<sup>6</sup> We get the most satisfaction from emotion, even turning fear and grief into positive experiences (as in horror films and tear-jerkers, respectively). Sensual pleasure is a poor second, although we do use imagination to heighten it by cultivating appetites for various patterns of sight, sound, taste, and touch. As Wallace Stevens said, “We live in the mind.” There has been no good term for the reward that does not require an association with physical events; it could be called mental reward, self-reward, or process reward, but these terms all have extraneous connotations. Elsewhere I have used “emotional” reward (Ainslie, 2001), since emotions are its best examples, even though “emotion” connotes an intensity that many examples do not have. “Imaginary” would suit, except that it connotes a falsehood or delusion. “Self-generated” reward is literally what I mean, but its connotation of deliberateness is also misleading. Here I will try out “endogenous” to refer to those rewards not governed strictly by sensory experience.

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<sup>6</sup> Some of this reward is “conditioned,” of course; but since it mostly lacks a believable unconditioned stimulus, the relationship to laboratory conditioning is a limited analogy. For the many problems of conditioned reward models, see Ainslie, 2001, pp. 19–22, and 2010a.

The neural mechanics of choice is becoming known. We try out scenes before entering them. This cannot yet be measured with the necessary specificity in people, but many studies have shown a rhesus monkey entertaining choices in its intraparietal cortex until an action threshold is reached (Glimcher, 2009). Even a rat in a maze has been found to model the maze in its hippocampus, and can be seen lighting up one arm of this mental maze and then the other over fractions of a second as it hesitates at a choice point (Johnson & Redish, 2007). This is the process that psychologist Edward Tolman described seventy years ago as vicarious trial and error (VTE; Tolman, 1939), but the concept fell into disuse. Nonhuman subjects are mostly weighing these possible scenes for how much concrete reward they will deliver and how soon, but humans' larger brains can create scenes that are worth staying in for their own sake.<sup>7</sup> We bring up a memory so as to relive a scene, or a plan so as to anticipate one, or another person's experience so as to model one, and may stay engaged with any of them for a considerable time without necessarily being moved to any actual behavior. Still, we cannot arbitrarily designate which of our imaginings will repay us for the time they take. We are constrained by whatever principle governs reward by imagination, and we are obliged to find this reward by VTE. There is no reason to think that a situation with endogenous rewards is different from that with physical rewards in cases where those rewards are freely available. We mentally try out whether we are ready for another cup of coffee, just as a rat that can self-administer unlimited cocaine can be seen emitting small striatal neuronal bursts to try out whether its appetite for cocaine has returned (Phillips et al., 2003, p. 616). In the same way we try out our imaginings for how they feel. In a marketplace based on prospective reward, a scenario<sup>8</sup> competes for our engagement against alternatives such as preparing coffee, taking a nap, or imagining something else. The question that must be answered is, how can scenarios without prospective external rewards, or with prospective external rewards that are extensively subject to interpretation, compete against alternatives with rewards that are nearby and certain? In other words, what makes a scenario worth spending time in?

Certainly its effect on external events is part of the answer: Is a given train of imagination instrumentally useful? That is, is it a plan or hypothesis about environmental contingencies, or some other mental process that is not rewarding in its own right but that will help bring about a situation that is? Conventionally we place a value on the rewarding effect a scenario would have if it predicted external events, then correct this value for the probability and delay of those events, and choose according to the resulting belief. But a great amount of imagination is not used to bring about or avoid events. People often seek out pleasant memories or are drawn into reliving horrid ones.<sup>9</sup> We buy large amounts of fiction—novels, cinema, video games—

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<sup>7</sup> Brain imaging has begun to supply some information about the construction of scenarios. Significantly, the same few parts of the brain, largely in prefrontal and medial temporoparietal lobes, seem to be active in all the major kinds of imagination—our memories of the past, the future we construct from those memories, the experience we attribute vicariously to others, and even, to some extent, the locations where these scenes might occur (Spreng et al., 2009).

<sup>8</sup> By “scenario” I mean any imagined or mooted sequence of experience—a concept as general as the constructionists’ “text,” but implying an element of choice according to which one text is selected over another on the basis of reward. Adding a basis for selection corrects the constructionists’ disregard of incentive (see Ainslie, 1993).

<sup>9</sup> Here is an illustration of the distinction between rewards and satisfactions (see note 6). Horrid memories compete on the basis of a rewarding component, but they are not satisfactions.

sometimes to the extent of impairing our real lives. Even our goal-directed plans are based on beliefs that are notoriously malleable, not only in the direction of wishful thinking but also toward hypochondria, obsessional doubt, paranoid jealousy, and the exaggerated worry that some cognitive therapists have called “catastrophizing” (Ellis & Grieger, 1977; subtler examples in Elster, 2010).

These distortions of planning are not simply mistakes. Some thinkers might argue that people’s notorious overvaluation of highly improbable events—the phenomenon that sells both high-jackpot lotteries and dismemberment insurance—is purely cognitive, an artifact of bad heuristics; but publishing the odds in lotteries does not seem to reduce enthusiasm for them. Likewise, objective reassurance has little effect on hypochondria. Superstitions resist scientific correction, and science itself has repeatedly been revealed to be cherishing false assumptions because of their reassuring tractability. People sometimes say they behave so as to go to heaven, the VTE of which has certainly not been shaped by experience; this is also true of young workers’ expectations for retirement or anyone’s plan for a remote period in her life. Ostensibly these plans are instrumental, but people’s persistent ignoring of realistic information about them suggests that they serve another purpose to a greater or lesser extent. Future scenarios may or may not come true, but to be entertained at all they have to deliver reward in the present, whether in the form of satisfaction or of giving in to an unwelcome appetite. The planned/fantasied retirement, vacation, or social victory must have a current savoring value, and the feared/fantasied disease, loss, or humiliation must urge itself on present attention in the form of current dread. To the extent that present reward is governed by something other than stochastic prediction, it represents another selective factor for scenarios—beyond their instrumental role—that could be called *hedonic*. But what are the constraints on hedonic selection?

**Endogenous reward comes to be governed by occasions.** As I argued above, hyperbolic impatience makes the imagining of even desirable scenarios *ad lib* relatively unrewarding because it condenses the appetizing phase, as in grazing. When one occasion for reward is as good as another, they will replace each other as soon as each is slightly fresher or temporarily more desirable, and the imagining will have the quality of a daydream. Conversely, if there is a unique or relatively rare—*singular*—occasion that stands out from the others, it will make the corresponding imagination more robust. The creation of singular occasions is elementary in a game such as solitaire: We bind ourselves with a personal rule that defines steps toward a scarce outcome. Such a rule has to be strict, but it will be self-enforcing, since if we cheat we undermine the suspense that is the sole purpose of the game.<sup>10</sup> Solitaire pays off poorly if we just imagine winning, or cheat. It pays off most when we win with optimal infrequency; only that scenario induces enough appetite to make the game more rewarding than not playing at all. Solitaire has, after all, no instrumental use. Setting up a challenge—making it important, “betting on it”—is the basic process for exploiting endogenous reward, most apparent in games and puzzles without instrumental purpose, but discernible in a great deal of human endeavor. In pursuing any long task we have to define what benchmarks will count as accomplishments, and hence as occasions for self-congratulation; here, too, wishful thinking will erode their rewarding effect. In another noninstrumental example, we can turn to fiction to provide a string of occasions for endogenous reward, which are undermined if we read ahead, surf television channels, or disengage emotionally from the scary parts of a film. In the rare cases where an

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<sup>10</sup> “Solitaire is the one game that requires absolute honesty.” Madame Armfeldt in *A Little Night Music*.

author offers a choice of contradictory outcomes—for instance, in the alternate endings of John Fowles' novel, *The French Lieutenant's Woman*—the same dysphoric feeling arises as with the temptation to cheat at solitaire.<sup>11</sup> The power of occasions to deliver endogenous reward depends on the person's discipline of accepting one particular source of them, and on the singularity of the occasions it offers.

There are many degrees of this singularity. Solitaire is only one game among many, and you can always put down one novel and read another—although five hundred pages into *War and Peace* the sunk cost is bound to have some committing effect. With more commitment a particular source of occasions gains power, even, hypothetically, a daydream. A believable example is depicted in Robert Coover's novel, *The Universal Baseball Association Inc., J. Henry Waugh, Proprietor* (1968). Here the protagonist experiences emotions so entirely according to a dice-driven baseball fantasy that it becomes more important to him than the real events of his life. When a rare throw requires him to kill his favorite character, he faces what could be called a crisis of belief, pitting the anguish of grief against his devaluation of the game if he cheats on the outcome. His rules for testing reality within his game had become as confining as someone else's for testing objective reality. To a lesser extent fictional works may achieve a degree of uniqueness by becoming cultural icons—as Schelling describes (1986) for the grief occasioned by the death of Lassie, a fictional collie on an American TV show.

To some extent the singularity principle also governs the power of realistic expectations to occasion endogenous reward. Authentic facts about the world are supposed to be valued for their instrumental usefulness, but at the same time they are a unique pattern of potential occasions. Realistic plans are those that maximize our prospects for external rewards. But milestones in such plans will also be excellent occasions for anticipation (or self-congratulation), a kind of endogenous reward—but only to the extent that we have appetite for that reward. If our plans have worked so well that they no longer excite us, conventional wisdom tells us to take this as an accomplishment and move on to new projects; however, if realistic obstacles arise, creating suspense, the accomplishment will be less but the hedonic outcome may be greater. The hedonic problem, of course, is that we have been relying on the instrumental importance of our plan to make its occasions for reward singular, that is, more than just the results of a game or fantasy. If we catch ourselves introducing obstacles to make the task more exciting, increasing hedonic but reducing instrumental productivity, we belie that importance. To maximize the plan's effectiveness in pacing our reward, we have to believe both in its importance and in the necessity of its obstacles.

Tom Sawyer was brazen about arranging obstacles. In *Huckleberry Finn* he points out the need to Huck:

Blame it, this whole thing is just as easy and awkward as it can be. And so it makes it so rotten difficult to get up a difficult plan. There ain't no watch-man to be drugged—now there OUGHT to be a watch-man. There ain't even a dog to give a sleeping-mixture to. And there's Jim chained by one leg, with a ten-foot chain, to the leg of his bed: why, all you got to do is to lift up the bedstead. . . .

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<sup>11</sup> To expand this example, I personally did not feel the same disturbance in the film because it depicted parallel plots, in the story and in a company filming the story, assigning one of the two endings to each. I attribute my different reaction to what was a very similar choice of vicarious experiences to the fact that the film did not threaten the convention by which I accept a unique string of occasions for my feelings.

There won't be nobody nor nothing to interfere with us, and so after all our hard work and trouble this escape'll go off perfectly flat; won't amount to nothing—won't be nothing TO it.

In real life the hedonic maximizer must find ways to keep her instrumental skills from confronting this kind of thinking. Foremost among instrumental skills is her vigilance against distraction from her goals, enforced by the intertemporal bargaining process described above—willpower. Successful bargaining leads to dependable progress toward the rewards that are at stake; but it may also spoil the excitement.

**The best occasions are surprises.** With mental satisfactions, the only way to stop our minds from rushing ahead to a predictable outcome is to avoid approaches that can be too well learned. Thus, the most valuable occasions will be those that are either (1) uncertain to occur or (2) mysterious—too complex or subtle to be fully anticipated, arguably the rationale of art. To get the most out of endogenous reward, we have to either gamble on uncertainty or find routes that, although certain, will not become too efficient. In short, our occasions have to stay surprising. Intertemporal bargaining results in predictability and in turn depends on it, thus serving to reduce the surprise that refreshes emotional appetites. To avoid confrontation with this effort, the hedonic maximizer must maintain her appetite through *indirection*, that is, through finding activities whose obstacles seem necessary (Ainslie, 2001, pp. 187–197). Since we can sense the emotional consequences of a line of thought before actually pursuing it (Shiffrin & Schneider, 1977), such concealment of purpose probably develops with experience, in the ordinary course of VTE. The important point is that although this process must be considered a form of denial, it not only produces reward in the short term like the denial that abets an impulse, but it also serves to keep two long-term reward strategies—to increase accomplishment and to increase appetite—from interfering with each other. If this motivated reasoning (Kunda, 1990) can avoid obvious violation of our personal rules for testing reality, it may permit a hedonically motivated task to avoid losing its apparent singularity. Thus, the satisfaction that depends on indirection belongs in Jon Elster's insightful category of “states that are essentially by-products” (1981).

The most elementary way to create a significant surprise is to gamble literally—to stake money on a race or a throw of dice. Sophisticated games invite people to risk their reputations, their safety, or their self-esteem in complex social interactions, even when their ostensible expected value is negative. However, such games are vulnerable to close examination that might reveal them to break major personal rules for getting and defending satisfactions. It is true that, in an activity we classify as hedonic to begin with, we recognize the rationality of an intermittent appetizing process—the extreme is the opiate addict's deliberate withdrawal to cheapen her habit—but this is not true of activities we see as instrumental. We would not allow ourselves to throw money away to heighten the satisfaction of earning more, or deliberately reveal an embarrassing secret so we could rebuild our reputations. And yet if we could let the risk of doing so persist alongside our straightforward plans to build our various kinds of wealth, such peril might lead to more net satisfaction than “rational” diligence—even when the objective cost was greater than the instrumental value.

In summary, both instrumental and hedonically motivated activities may serve long-range interests—the former in getting goods that satisfy appetites, the latter in maintaining and refreshing those appetites. They are often the same activity, and not just by coincidence: Instrumental effectiveness is one of the most reliable bases for singularity, so an activity that is hedonically productive, but that can also be authenticated as instrumental, will have a great

competitive advantage in the marketplace of choice. If the activity demands significant risk but can still masquerade as instrumental, it may produce more satisfaction than either the most efficient instruments or the cleverest of games by themselves.

## Gambling May Be More Than Impulsive

We can finally address the question of why gambling is such a robust activity in some people—more than an impulse but a life companion, a love affair with Lady Luck that can take its place among other ostensibly foolish love affairs with partners ranging from rejecting lovers to murderous mountains (e.g., [Leamer, 1999](#)). The key in all these activities is the value of risk in refreshing appetite. A perception of risk is almost impossible to achieve without intermittent loss (some physical stimuli such as roller coasters excepted). Since the value of appetite usually cannot be weighed directly against instrumental value, for reasons described above, the question of whether the hedonic gain from the risky activity is worth the instrumental losses is apt to be hard to answer, particularly because hyperbolic discounting will make any answer different from short- and long-range perspectives.

Utility theory expends a great deal of effort in figuring out whether people behave rationally toward the events they value. If we take the gambler at her word that she values money, then her repeated seeking of an activity that can be expected to lose money is a puzzle to utility theory. Proposed explanations tend to focus on cognitive errors—a failure to compute odds correctly, a belief that an improbable string of events will lead to a reversal (the gambler’s fallacy) or that an improbable string of events will tend to continue (the hot hand illusion). The gambler’s failure to learn from experience is attributed to innumeracy, impulsiveness, or, in an outmoded theory that may have been groping after an important idea, an unconscious wish to lose.<sup>12</sup> The gambler herself believes that the value of gambling comes from the chance to win money, and researchers have taken her word for that. Thus, a recent self-report study found that problem gamblers experienced enough excitement to cause visceral symptoms equivalent to alcohol withdrawal when it stopped—including in a subsample who had both alcohol and gambling problems—but that subjects overwhelmingly “reported that increases in bet size were motivated by increasing chances of bigger wins or for hopes of changing luck rather than for excitement” ([Blaszczynski et al., 2008](#), p. 187). “The majority reported motivations that were more consistent with a cognitive rather than an addiction interpretation of gambling . . . that the erroneous perceptions pertaining to the gambler’s fallacy and luck accounted for their reason to increase bet sizes, not the desire to generate desired levels of arousal or excitement” (*Ibid.*, pp. 188–189). However, this conclusion ignores the necessary presence of a motivational factor that keeps problem gamblers from re-examining their instrumental beliefs. Someone whose primary goal actually is wealth should eventually do some simple arithmetic, or be driven by experience into taking the word of experts who have calculated the odds.

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<sup>12</sup> “The gambler is a neurotic with an unconscious wish to lose. His logically senseless conviction that he will win is an expression of the fiction of omnipotence in the child who escaped destruction in a real experience. Gambling also activates the latent rebellion against logic, morals and renunciation, a rebellion which is based on the inwardly unrelinquished pleasure principle. Heavy inner retaliation and an unconscious tendency toward self-punishment follow his unconscious aggression. He cannot win in the long run because losing is necessary for his psychic equilibrium” ([Berliner, 1945](#), p. 138).

Gamblers' self-reported rationales are apt to be as unreliable as those of smokers, who regularly fail to report what has been demonstrated to be the essential feature of cigarettes, the nicotine effect (Spielberger, 1986). However, smokers confabulate reasons to smoke because the effect of nicotine is not directly sensible (Goldfarb et al., 1970), not because they have a long-range interest in smoking. Gamblers, by contrast, would undermine the instrumental validity of their activity if they failed to view getting money as its key objective. As long as this belief survives, gambling can be a source not just of short-term satisfaction, but of at least relatively long-term satisfaction as well. Gamblers thus have durable incentives to manipulate their instrumental beliefs, although they must also avoid detecting this manipulation. Stimulus-seeking personalities, in whom habituation occurs especially quickly, may consistently prefer a life of "wasting" resources on gambling to one of quiet desperation, even when they say they acknowledge the waste and seem to be making efforts to end it. They face an ongoing struggle between acknowledging the primacy of their hedonic return from gambling and maintaining the belief in its instrumental effectiveness, which is what keeps it from deteriorating into fantasy.

To the extent that the gambler chooses patterns with negative expected value, we have reason to believe that the money has become a MacGuffin—the object of a hedonic game that is justified by its instrumental believability but which is actually shaped by its production of satisfaction in its own right. We may make mistakes about this attribution, of course. The gambler may sometimes make unmotivated cognitive miscalculations, just as conventional theory says. Conversely, in pursuing patterns' MacGuffin value she may happen to choose those that actually have a positive instrumental value. This might be true if she were gambling on stocks, for instance, instead of dice. The giveaway is her reliance on the activity to produce ongoing emotional reward without the kinds of delays that are normal in instrumental investing. In stock market investing she would be led to day trading, which is apt to have negative expected value because of her hedonic need to get frequent payoffs. Even in mainstream investors current hedonic value can be seen competing against instrumental efficiency in such phenomena as the sunk cost fallacy (Arkes & Blumer, 1985). The same distinction is visible within gambling, where a successful race track punter bets on a minority of races, and a poker player who consistently makes money restricts her bets to a small minority of hands (McCormack & Griffiths, 2011). The distinction is evident in many professions that have a high hedonic potential, for instance, in dealers in collectibles, who are distinguished from the amateurs who support them by not showing the instrumentally irrational but hedonically potent phenomenon of loss aversion (Haigh & List, 2005). A MacGuffin is especially insidious when the value it adds to a purely instrumental activity is hard to weigh. With enough talent and discipline, skill-based gambling, day trading, and dealing in collectibles are instrumentally productive, and there is no bright line marking how much talent or discipline is enough.

MacGuffin-based addictions are a special class, distinguishable from simple dissipations like drug taking or sexual excess in that they have parasitized the person's instrumental endeavors. Nor is such parasitism necessarily short-sighted. The element of risk may be a durable support for appetite and thus may increase the person's long-term satisfaction over what purely instrumental activities could do. Seen from a hedonic perspective, a gambler's losses are investments in the emotional impact of her eventual wins, and are undesirable only to the extent that they interfere with richer long-term emotional activities or, of course, cause her to go broke. Even without the appetite factor, defining a string of wins and losses by its first win and discounting that win hyperbolically will yield a positive expected value for a string with no net undiscounted cash return (Rachlin, 1990). But this is true only in the period just before this win.



Counting the appetite-renewing effect of suspense, the string might seem to be an improvement over predictable wealth maintenance even when viewed from a distance. Authenticated as part of a project for gaining wealth, such strings may have more long-term preferability than a steady income.

Even counting its long-term hedonic value, gambling can be an addiction as ordinarily understood: an activity that is strongly motivated in the short run but which the person is motivated to control or avoid from the perspective of distance. Its appetizing effect pays off especially in the immediate future, and alternative activities are apt to become less possible to the extent that a person becomes preoccupied with it—as is the case with other addictions. Neurophysiological observations in problem gamblers include a sensitization to gambling-related cues and an absence of habituation that are similar to the findings in cocaine addiction (summarized in [Ross et al., 2008](#)), suggesting incidentally that drugs may not supply anything that cannot be had from highly effective pacing patterns of endogenous reward. However, pacing intense reward by gamblers requires their outcomes to be of singular importance. The effect cannot be achieved at church casino nights, nor can the rich avoid staking significant portions of their riches. To appease the enmity, as it were, of the person's instrumental interests, gambling to this degree must seem to have instrumental validity.

The determinant of when gambling will become addictive may lie less in its payoffs and costs than in what satisfaction the person sees as alternative to it. The sequences of intense craving and glorious satisfaction that gambling entails seem to appeal especially to people who feel beset by their failure to solve problems in their ordinary lives, and who therefore need gambling's intensity to keep their attention from being drawn back to this failure. When problem gamblers are interviewed in depth about their motives, they acknowledge some form of mood manipulation just as substance addicts do—blocking out their problems, “buzz,” filling a void—in the service of escaping life problems ([Wood & Griffiths, 2007](#)), which, of course, come to form part of their appetites for gambling. To be a net source of satisfaction, gambling requires the same moderation as other potentially addictive activities, and lacks benchmarks for where that moderation stops. Furthermore, for most people the long-term hedonic value of risk is better exploited in economic and social activities that have a wider range of choices and outcomes than are available in the stereotyped bets of conventional gambling games.

The value of money has a significant MacGuffin component in many of a wealthy society's activities—when we pursue it as a token of accomplishment or victory rather than for the sake of what we plan to buy with it (see also [Lea & Webley, 2006](#)). However, we nowhere see it separated from its instrumental purpose as much as we do in addictive gambling. Just as the example of procrastination offers a chance to study the hyperbolic discounting of reward without having to deal with an arousal factor ([Ainslie, 2010b](#)), the study of gambling may let us observe the arousal of appetite without the participation of a physical object, and particularly to observe the coexistence of this arousal with a rationality that does not recognize its value. Ross and his collaborators were right to call addictive gambling “the template of ‘basic’ addiction, the form on which all other addictions are complications” (2008, p. 163).

An understanding of gambling and other non-substance addictions requires exploration of the vast human topic of endogenous rewards—those rewards that are always at hand in our mental repertoires, without needing to be unlocked by innately programmed stimuli. I have hypothesized that such rewards can exist without leading to self-reward-at-will because the hyperbolic function with which we discount delayed rewards leads to rapid habituation of any endogenous rewards that we do not bind to adequately singular and surprising occasions. I

propose that the pursuit of risky instrumental tasks—exemplified by gambling to make money—often generates such occasions, but only if getting the endogenous reward is perceived as subordinate to the task’s instrumental purpose. This contingency sets up an incentive to be inefficient at evaluating the instrumental value of the risky tasks, an irrationality that may nevertheless produce both short- and long-term increases in reward because it supports the refreshment of appetite.

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