

Procrastination: The Basic Impulse
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Text

Webster defines “procrastinate” as “to put off until tomorrow, or from day to day;” it generally means to put off something burdensome or unpleasant, and to do so in a way that leaves you worse off. By procrastinating you choose a course that you would avoid if you chose from a different vantage point, either from some time in advance or in retrospect. Thus the urge to procrastinate meets the basic definition of an impulse—temporary preference for a smaller, sooner (SS) reward over a larger, later (LL) reward. I will argue that it is the most basic impulse, the one in which the disproportionate value of the immediate future can be seen without confounding factors.

The motives we think of as impulses usually involve an impending thrill, a vivid sensation that is hard to resist. Examples include eating rich food, drinking, taking recreational drugs, having sexual encounters and making purchases. Often impulses are focused on a physical activity or consumption good, which makes them easier to understand in terms of conventional utility theory. But many impulses involve no consumption. It could be argued that gambling is the most basic impulse, because it requires no physical stimulation, only surprise. The emotions occasioned by play in an addicted gambler are as strong as those provoked by drugs, and are followed by the same physical symptoms on sudden discontinuation.¹ But gambling also creates a thrill in the short run. More basic still must be the simple temporary preference for less cost in the present over the greater cost that leads to a better deal in the long run. Procrastination needs no great pleasure to drive it, and no activity to instantiate it. It is just the venerable sin of sloth.

Most impulses have definable boundaries. Sometimes the impulsive act itself is naturally demarcated—you take a drug or you don’t. Even where no line divides the harmful from the benign, there is usually a definable topic that can be subjected to rules—diets to define overeating and budgets to regulate spending and gambling. But the impulse to procrastinate is diffuse, seeming to grow pervasively from the way we experience time. It always feels better to defer costs. We put off going to our workroom; in our workroom we put off cleaning it; when cleaning it we put off the grungy or monotonous parts. However small the unit of activity, we are drawn from the more tedious parts to the less. This is not to say that we always do the work in that order; we are apt to make a rule to do just the opposite, and follow the rule so habitually that it becomes second nature. But the rule is our response, not the original impulse. Where the impulse comes from a

¹ Ian Wray and Mark G. Dickerson, “Cessation of High Frequency Gambling and ‘Withdrawal’ Symptoms.”

reward that is too imminent, too variable, and/or too vague to control with a rule, it simply prevails. For instance, the more interesting parts of a picture “jump out” ahead of the less. A personal example: Whenever I have a choice as to the order in which I add columns of figures, I add the ones that look like they will produce round numbers first, even though a systematic approach would probably be more efficient. It’s hard to be sure, when the competing behaviors each take fractions of a second.

Hyperbolic discounting as a mechanism of procrastination

There is debate about what causes impulses. Sometimes they are attributed to naiveté, or inability to estimate the values of the contingencies involved. But impulses, including procrastination, persist despite the person’s great familiarity with the outcome. A popular explanation is to say that the “viscerality” of an SS reward—its emotional evocativeness—can make it preferable to an LL alternative when it is close but not when it is distant.² But procrastination can occur at such a low level of interest that viscerality would have to imply only the quality of being marginally more attractive than some alternative, that is, nothing more than rewardingness itself. Instead I would argue that the occurrence of procrastination among even the most mundane alternatives is evidence for a pervasive tendency to perceive value as a hyperbolic function of delay, an instance of the Weber-Fechner law by which most psychophysical quantities are perceived.³

Mathematically, the discount function is

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

where Value_0 = value if immediate and k is degree of impatience. A plot of this function against delay shows that, for some combinations of SS and LL rewards with a constant lag between them, SS rewards will be temporarily preferred when they are close. This pattern contrasts with the prediction of the exponential curve that is necessary to produce consistent choice over time:

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

where Value_0 = value if immediate and $\delta = (1 - \text{discount rate})$.

A general tendency for both humans and nonhumans to discount prospective rewards hyperbolically has now been widely documented.⁴ Hyperbolic discount curves describe

² Douglas Bernheim and Antonia Rangel, “Addiction and Cue-Triggered Decision Processes.”; David Laibson, “A Cue-Theory of Consumption.”; George Loewenstein, “Out of Control: Viscera Influences of Behavior.”

³ John Gibbon, “Scalar Expectancy Theory and Webers Law in Animal Training.”; For the possibility that hyperbolic discounting is based in the elementary dynamics of receptor saturation by neurotransmitters, see Gregory Berns *et.al.* “Receptor Theory and Biological Constraints on Value.”

⁴ George Ainslie, “Breakdown of Will.”; Leonard Green and Joel Myerson, “A Discounting Framework for Choice with Delayed and Probabilistic Rewards.”; Kris

conflicts between short and long range motives. Short range motives are based on the spike of value that occurs as a reward gets closer. Long range motives are based on the values described by the tails of the curves that describe value at a distance, which are much lower but have the tactical advantage of governing first. Each may survive in competition with the others as long as it sometimes gets its goal. A motive and the behaviors that have been learned on the basis of this motive can be called an interest, by analogy to economic interests in the larger world.⁵

If procrastination is defined broadly, as temporary preference for early reward at the expense of greater reward later, it becomes the same thing as impulsiveness, which has been extensively reported in the above experiments. It will be more useful to follow common usage and define procrastination negatively, as preference for deferring aversive experiences rather than just a preference for SS rewards. However, the shape of its discount curve in this case has been little studied. With human subjects there has been only a Dutch survey in which undergraduates were asked to rate their motivation to study in the face of five kinds of temptation, such as social invitations or favorite TV shows, as a function of the delay before an exam.⁶ Although both the exam and the delays were hypothetical, subjects estimating their likely motivation produced a hyperbolic curve for all five temptations. This shape might seem to predict that the relative values of partying and passing an exam will shift over time, but the experiment was not designed to elicit changes in relative value; this would have required a constant lag between partying and exam, and evaluation at a variable distance before both.

The nonhuman literature is not much fuller. If pigeons are given the choice between interruption of intermittent noncontingent reward by an obligatory five-response task (FR5) after six seconds, or a harder task after a longer delay, they will accept harder and harder tasks as the delay before they have to perform them is lengthened. They will often accept tasks that are more than three times as hard (FR>15) if the task is delayed by only a few seconds more.⁷ However, this design, too, fails to demonstrate preference reversal as a function of delay. Analysis of preference as a function of delay in a similar experiment where the longer, later task was a duration of required pecking (FI7.5 or FI15 vs. FI5) showed that the discount *rate* varied with delay, implying a curve like a

Kirby, “Bidding of the Future.”; James Mazur, “Hyperbolic Value Addition and General Models of Animal Choice.”

⁵ Any reward that is sometimes chosen could be seen as giving rise to an interest, but the term is useful only when one interest includes motivation to interfere with another interest. A student who feels like watching TV would not increase her prospective reward by controlling a desire to play frisbee; there is no point in calling these separate interests. But both may be included in a short range interest in procrastinating, which succeeds to the extent that it evades a long range interest in doing well on her exams.

⁶ Henri Schouwenburg and Jan Groenwoud, “Study Motivation under Social Temptation.”

⁷ James Mazur, “Procrastination by Pigeons: Preference for Larger, More Delayed Work Requirements.”

hyperbolic one that could produce temporary preferences.⁸ This finding confirmed the implication of an earlier concurrent interval study in which rats preferred a schedule that intermittently delivered LL shocks instead of SS ones when the delays to the SS shock were small.⁹ However, all the criteria for impulsive procrastination—preference for an LL pain over an SS one in discrete trials, if and only if the SS pain would be immediate—have been met only by Marvin Deluty *et.al.*¹⁰: Rats were given repeated trials in which they could spare themselves an eventual 5.0 second foot shock by accepting a much briefer, 0.5 second shock a few seconds earlier. When the brief shock would occur immediately subjects rarely accepted it; when the brief shock would not occur for a period varying from 20 to 60 seconds, subjects' rate of accepting it varied from 50% to 80-95%. Thus the rats preferred a few seconds of comfort to a brief shock that would prevent a much longer shock, but only if this comfort was nearby—*temporary preference*.

Experimental analysis of procrastination is still in its infancy. Nevertheless, we can predict that ways of controlling procrastination will not be as simple as in the control of a single clearly demarcated behavior. The kit of tools that works against discrete impulses will not be as effective against procrastination.

Best understood are forms of precommitment. Pigeons can learn to peck a key, the only effect of which is to prevent a tempting option from being offered subsequently.¹¹ The latter rat experiment just described found that subjects would choose an option that committed them to get the SS shock, but only if they chose while the SS shock would still be distant.¹² The choices in these experiments were predicted by the discounted value of the alternative outcomes at the time the subject chose, and did not require awareness a need for commitment. Subjects who are aware of the problem, presumably only humans, can actively arrange for external controls such as deadlines, or, even better, series of sub-deadlines.¹³ Or we can associate with people who share our long range interests and exert pressure, directly or by example. This kind of external control may or may not be available, and may have undesirable costs—excessive restrictiveness, say, or side-demands by the other people. Alternatively, we can avoid information on the availability of distractions—keep the TV off, and don't call friends to ask what's happening; or we can avoid toying with appetites that may grow to be overwhelming, such as fantasizing about resentments, romances, or favorite kinds of thrills. However, plans maintained by such controls on our attention or emotions will be unstable, vulnerable to re-weighings of options that may give a short range interest an opening. Furthermore, the exploration of possible information or emotion will be tempting in itself, and some incentive will be

⁸ James Mazur, “Procrastination by Pigeons with Fixed-Interval Response Requirements.”

⁹ Marvin Deluty, “Self-Control and Impulsiveness Involving Aversive Events”

¹⁰ “Self-Control and Commitment Involving Aversive Events.”

¹¹ George Ainslie, “Impulse Control in Pigeons.”

¹² Marvin Deluty et. al., “Self-Control and Commitment.”

¹³ Dan Ariely and Klaus Wertenbroch, “Procrastination, Deadlines, and Performance.”

needed to maintain our plan of not exploring. As with other kinds of impulse, the most effective control for procrastination is usually willpower.

The use of will against procrastination

Will has been an elusive concept, partly because of multiple meanings, but more importantly because it has lacked a clear mechanism of action. The term will has been applied to the process of connecting thought with behavior—a holdover from philosophical dualism, found superfluous by Gilbert Ryle¹⁴—and to your sense of ownership of your actions-- shown to be often misleading by Daniel Wegner¹⁵ -- as well as to a faculty for controlling impulses like procrastination. The nature of the impulse-controlling faculty has been variously depicted as resembling a muscle,¹⁶ as an application of attention control,¹⁷ as a learned loss of taste for short term rewards (“molecular” vs. “molar” rewards;¹⁸), as a function that in principle cannot be analyzed,¹⁹ and again as a concept that is superfluous because people always maximize prospective reward.²⁰ However, the discovery that reward discounting is an innately hyperbolic function permits an explicit hypothesis about how will operates: Hyperbolic discount curves predict a relationship of limited warfare among successive motivational states, which can be stabilized along truce lines by the person’s perception in each state that her current choice will function as a test case of the relevant truce (or *personal rule*). That is, a self-aware person notices that her current choice of an SS or LL reward is evidence about whether she will pick SS or LL rewards in similar situations in the future, and thus finds that her expectation of a bundle of prospective rewards is at stake in a choice that literally determines only one.²¹ This perception supplies the force that the Victorian psychologist James Sully said was added to an otherwise weaker alternative to give the will its strength.²²

This hypothesis about the mechanism of will has two parts. The first is that bundling prospective rewards into series increases the present value of LL rewards relative to their SS alternatives, contrary to what exponential discounting predicts.²³ This effect has been shown experimentally in both people²⁴ and rats,²⁵ the latter finding being proof that the

¹⁴ “The Concept of Mind.”

¹⁵ “The Illusion of Conscious Will.”

¹⁶ Roy Baumeister and Todd Heatherton, “Self-Regulation Failure: An Overview.”

¹⁷ William James, “Principles of Psychology,” pp. 562-565; Michael Bratman, “Faces of Intention: Selected Essays on Intention and Agency.”; Edward McClenen, “Pragmatic Rationality and Rules.”

¹⁸ Howard Rachlin, “The Schience fo Self-Control,” pp.108-129

¹⁹ Arthur Pap, “Determinism, Freedom, Moral Responsibility and Causal Talk.”

²⁰ Gary Becker and Kevin Murphy, “A Theory of Rational Addiction.”

²¹ George Ainslie, “Breakdown of Will.” pp. 90-116

²² James Sully, “Outlines of Psychology,” p. 669

²³ Summed *exponential* curves from pairs of SS and LL rewards have no more tendency to cross than curves from a single pair (George Ainslie, “Breakdown of Will,” pp. 78-85).

²⁴ Kris Kirby and Barbarose Guastello, “Making Choices in Anticipation of Similar Future Choices can Increase Self-Control.”

effect is not an artifact of cultural suggestion. The second part is that the very perception of the present choice as a test case for similar choices in the future puts a bundle of the expected rewards for those choices at stake. This part has intuitive appeal, but is only tangentially available to empirical test. Kris Kirby and Barbarose Guastello found that students who made choices weekly were more apt to choose LL rewards if it was initially suggested to them that a current choice had predictive value,²⁶ but this is not definitive proof. More substantial evidence comes from a tightening of introspection by means of thought experiments, which, I have argued, can be interpreted conservatively to test hypotheses just as controlled experiments can.²⁷ Simplest is Monterosso's problem: Imagine that you are trying to stop smoking, and an angel tells you that you will never smoke after today, whatever you do now. Do you smoke a cigarette now? (Why not?) Now imagine that the angel says you will always smoke after today, whatever you do now. Do you smoke a cigarette today? (Again, why not?) These and other intuitions can be interpreted as demonstrating that the way you are motivated to forego a current indulgence is by how it affects your expectation of future indulgences.²⁸

From here on I will assume that the mechanism of willpower is the perception of current choices as test cases for bundles of prospective reward. This is *recursive self-prediction*, which can change your prospects of reward several times before you make a single choice. When dealing with procrastination, the will's maneuver is to ask, "if not now, when?" Unfortunately from the viewpoint of your long range interests, this is not a rhetorical question; a short range interest will readily answer it with, "tomorrow when I'm rested" or "in that empty time slot I'll have next week." The will's vulnerability is to rationalization. Although an expected sequence of LL rewards may have more present value than the sequence of their SS alternatives, the sequence of SS now and LL thereafter, if believable, has the most present value of all. To the extent that a person relies on willpower, the success of impulses will depend not on the imminent availability of gratification, but on the existence of a credible excuse that lets her expect to be, as in St. Augustine's prayer, "chaste and continent, but not yet."

The credibility of the excuse is the pivotal factor. If you start to accept waiting until you are rested as an excuse, your estimate of whether you will get the task done at all may fall. That is, you may expect your future selves to interpret it as a lapse and decide to lapse themselves, thereby reducing the credibility of your resolutions in this area. The threat of this fall may move you to reject that excuse and do the job—or find a better excuse. As you survey the possible excuses and your likelihood of buying one, your predictions of getting your long range reward may seesaw violently, variations that are fed back recursively over a period of mere seconds until you actually behave in one way or the other. The sensitive dependence of choice on self-prediction is arguably the source of enough introspective opacity to account for the experience of free will in a mechanism

²⁵ George Ainslie and John Monterosso, "Building Blocks of Self-Control."

²⁶ "Kris Kirby and Barbarose Guastello, "Making Choices."

²⁷ George Ainslie, "Can Thought Experiments Prove Anything About the Will?"

²⁸ John Monterosso and George Ainslie, "Beyond Discounting: Possible Experimental Models of Impulse Control."

that is strictly determined by incentives.²⁹ In order for will to operate, the summed, discounted value of the bundle of prospective rewards at stake must be more than the discounted value of the present impulse, and resisting the impulse must seem both necessary and sufficient for eventually obtaining this bundle. If a credible excuse is available, resisting the impulse will not seem necessary. Conversely, if you have given in to too many similar impulses in the past, resisting this one may not seem sufficient to reverse the trend. As the “strength” model also predicts, exercise gives the will more power³⁰; but unlike the prediction of the strength model the power is somewhat specific to particular temptations—perhaps to procrastinating but not to smoking—and is affected asymmetrically by exercise and lapse: “Every gain on the wrong side undoes the effect of many conquests on the right”.³¹

To be credible to a sophisticated decision-maker, an excuse must be unique, one that holds only for today, or at least infrequently enough that neither it nor similar excuses occur too frequently to preserve adequate value in the bundle. Perhaps you forgot that your son’s piano recital was today. That would be a credible excuse, one that you would not later see as a rationalization and thus evidence against the credibility of your resolve. But by its very nature a credible excuse has to be a stroke of luck, not something that you can find by looking for it. It also has to stand out from other excuses that would be too available, such as your nieces’ and nephews’ recitals, and their soccer games, and your favorite team’s soccer games... A property that distinguishes a credible excuse from any old pretext is a *bright line*: your own children vs. other children, recitals vs. mere lessons, championship games vs. others. In *interpersonal* bargaining, bright lines have long enabled hostile parties in legislatures to reach stable compromises. In *intertemporal* bargaining they form a major determinant of how much impulsive motivation can be resisted by willpower. Most smokers manage to quit³² as do about half of alcoholics,³³ aided by the bright line between some consumption and no consumption at all. By contrast, five percent of overweight dieters manage to achieve long term weight reduction.³⁴ Where temptation is both strong and dangerous, a bright line may make it possible to renounce all excuse-making and follow a twelve-step program in declaring, “I am powerless against [the relevant impulse].” Far from abdicating self-control as some have feared,³⁵ the perception that your will is naked against temptation makes it strong, albeit rigid. It offers a more effective alternative than “controlled drinking,” but there is

²⁹ George Ainslie, “Breakdown of Will,” pp. 129-134

³⁰ Mark Muraven et. al., “Longitudinal Improvement of Self-Regulation Through Practice.”

³¹ Alexander Bain, “The Emotions of the Will,” p. 440; See John Monterosso et. al., “The Fragility of Cooperation.” for an experimental model.

³² Andrew Garvey et. al., “Smoking Cessation Patterns in Adult Males Followed for 35 Years.”

³³ John Helzer et. al., “Akcihol Abuse and Dependence.”; R. G. Smart, “Spontaneous Recovery in Alcoholics.”

³⁴ D. M. Garner and S.C. Wooley, “Confronting the Failure of Behavioral and Dietary Treatments of Obesity.”

³⁵ Neil Levy, “Self-Deception and Responsibility for Addiction.”

no alternative to controlled eating or controlled spending; to declare yourself to be powerless over food or purchases would dictate no safe course of conduct.

Even less is it possible to give up procrastination. “Never put off until tomorrow what you can do today” is a brave slogan, but it is literally impossible not to put off most of what you actually can do. You have to continually make selections, and not just among big alternatives but among a continuum of middle sized, small, and tiny ones. Not only are potential boundaries between categories of choices often lacking, but impulsive incentives are often inextricably mixed with rational ones. Colorably rational reasons to put off a task include:

1. to take advantage of a better present opportunity
2. not to squeeze it into a busy schedule when you will have more time later
3. to dispose of a potential distraction
4. to commit yourself not to devote more time to the task than it deserves

1. Alternative opportunities can be evaluated by many rationales. For instance, the hypothetical examples presented to students in the Dutch survey on reasons to put off studying used these examples:

- Friends call with an invitation
- A favorite TV show is on
- A temporary employment agency calls offering a job
- You walk by a party in a nearby room
- A fellow student comes to your door³⁶

A student must make a fresh evaluation each time about how rare and how valuable the opportunity is, at a time when motivation to take it is strongest, *i.e.* when it is imminent. How many invitations come, would she miss this show more than others, how good a job is it and how much does she need it, how many parties happen in nearby rooms? Without information about these properties the subjects imagined similar answers for all five cases, but showed a trend toward putting off studying more for the fellow student at the door. This result makes sense, since on the face of it this occasion is more special. Still, the judgment of being special will be determined by which fellow student it is, how often people come to the door, what this one wants, whether she could reasonably be put off, how much social obligation there is, and so on, all reasons that potentially affect whether the individual will feel the need to count this as a test case for her resolution not to procrastinate. Where an occasion is predictable, such as a TV show, she could be more objective by resolving in advance to see it or not, thus avoiding having to decide during the hyperbolic spike that precedes an imminent opportunity, but such advance warning is often not available. Where a temptation is recurrent, past judgment calls become a factor as well: “This TV show isn’t very special, but I’ve been letting myself see it before I study so I might as well go on doing so.” A baggage of old compromises and sheer happenstances provide historical boundary lines that offer themselves as excuses.

2. A sparser future calendar suggests that spacing out tasks might be objectively efficient. However, people are poor at estimating what will arise to fill it as a time gets closer, and

³⁶ Henri Schouwenburg and Jan Groenwoud, “Study Motivation.”

regularly expect to be less busy despite having been wrong about this repeatedly.³⁷ Sometimes a task really would be better assigned to a future slot, but it seems to be hard to discriminate such cases from wishful thinking.

3. Likewise, it seems rational to dispose in advance of distractions that might interrupt a task. However, cases where advance preparation is clearly called for, such as assembling necessary files, shade over into cases where you are just taking advantage of technicalities in your rules for authenticating productivity. To procrastinate while staying compliant you can give yourself credit for preparing your work site, collecting relevant information, checking your mail and email, forestalling people who might call you by calling them first, taking action on any problem that might worry you while you try to work, getting food so you will not be hungry, adjusting the thermostat, and so on. The blocked author who sharpens dozens of pencils has become a cliché. It is possible to catch yourself at this activity and stop it in individual instances, but probably not to avoid trying a new version next time-- pushing the edge of justifiable preparations.

4. I have argued elsewhere that personal rules do not necessarily maximize long range reward, because the risk that a person may interpret choices as lapses may make her compulsive—prone to adopt concrete rules over subtle ones and to err on the side of observing them.³⁸ This consideration creates a long range incentive to sometimes limit the scope of a personal rule. In the midst of doing a task personal rules may hinder judgment calls about how thorough or painstaking to be, and prevent cutting corners where that would be called for by an objective appraisal of efficiency. If you are aware of a tendency in yourself toward misplaced perfectionism, a rational tactic may be to commit yourself to jettison unnecessary parts of a task by making time so short that you have to. Of course this is a crude tactic, and apt to be misjudged, especially if adopted when the urge to procrastinate is strongest.

Another way to look at the limitations of personal rules is to see them as creating a principal/agent problem.³⁹ A long range interest, as principal, can be regarded as supervising successive motivational states of the person (agents) by means of personal rules. The purpose of personal rules is to organize enough incentive to keep the long range interest continuously dominant over many successive states. However, an individual agent (the person at a given moment) may increase her discounted expected reward by following a short range interest to a limited extent, stopping short of violating a rule and thereby reducing the expected reward that depends on this rule. This is an *intertemporal* variant of the *interpersonal* situation where an employer (principal) tries to accomplish a task by hiring an agent who does not have an interest in the outcome of that task, paying her as long as she follows the principal's instructions. The agent may then maximize her personal welfare by looking busy, being passive where an instruction does

³⁷ Gal Zauberman and John G. Lynch Jr., “Resource Slack and Discounting of Future Time Versus Money.”

³⁸ George Ainslie, “The Dangers of Willpower.” and “Breakdown of Will,” pp. 143-160

³⁹ James Mirrlees, “The Optimal Structure of Incentives and Authority Within an Organization.”; Stephen Ross, “The Economic Theory of Agency.”

not require action, focusing on the letter of the instructions rather than on any personal sense of what will bring results, and making her work as opaque to the supervisor as her instructions allow—the classic outcome of command economies. Within the person, the principal/agent relationship leads to maximization of the welfare of the current moment, which may entail a similar passivity, doing good-sounding, easy tasks before genuinely productive ones, and not auditing her choices too closely. The result will not be frank impulsiveness, but stealthy procrastination. The agent of a given moment does have an interest in the long term outcome, but may find many small ways to pilfer from this outcome without reducing its discounted, expected value as much as she increases her current, undiscounted reward.⁴⁰ As in interpersonal economies, the best strategies will give individual agents the greatest possible interest in the long term outcome, that is, make the necessary steps rewarding in the short run as well as the long run.

Procrastination in emotional reward

We humans notoriously live inside our heads. That is, *reward*, which selects among our options, does not depend strictly on the environmental *rewards* that reliably shape the choices made by most animals.⁴¹ 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 not necessarily connected to physical rewards. And to shape current choices, all of these categories must boil down to the third—occasions for present emotion. Our choices have no intrinsic momentum, so that even the greatest of long term projects must be chosen and chosen again, whenever a possible alternative is imagined, according to its current reward value.⁴² Likewise the past matters to us only to the extent that it is the occasion for present feelings; there are people who are largely successful in discarding this option, who report that they never revisit their histories, who “live only for the present.” We conjure up so much that is not in our current sensory fields that we live as if in a video game, cultivating some virtual scenarios and trying to avoid others, able to even prevent the intrusion of physical reality in many cases, but unable to prevent the intrusion of imagined horror in other cases. Much (I would say most) reward that modern people experience from goods of various kinds is physically 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 well. There has been no good term for the reward that does not require an association with physical occasions; it could be called mental reward,

⁴⁰ To the extent that the agents find these evasions by trial and error, without being aware that they are imperiling the long term goal, this process may be described by Chrisoula Andreou’s intransitivity model (this meeting); but eyes-open impulsiveness requires the person additionally to be a hyperbolic discounter.

⁴¹ The use of “reward” for both the internal selective process and an event that occasions it invites confusion, but there seem to be no simple alternatives. When I use “reward” without an article I am referring to the internal process, the one that makes the choices it follows more likely to be made again; “a reward” or “rewards” mean the events that occasion this internal reward. “The reward” is ambiguous, and I will try to avoid it.

⁴² True, there is a way that we can avoid subjecting plans to re-weighing for short periods of time—just to direct our attention away from alternatives—but our ability to avoid re-examining a plan in the face of temptation is limited.

self-reward, or process reward, but these terms all have extraneous connotations. I will use *emotional reward*, since emotions are its best examples, even though “emotion” connotes an intensity that many examples do not have.

Even reward from a concrete commodity such as food, ostensibly released by a specific turnkey, can be partially summoned in imagination by the people who read cookbooks for pleasure; the fantasy prone are said to be able to get the same satisfaction as from a meal.⁴³ Similarly, even reward from an instrumental device such as money includes a component that is independent of its instrumental value, that is, independent of what the money can buy.⁴⁴ And what we buy are more apt to be ways of occasioning emotion—fiction, vacations, sports tickets, fashions, aids to the companionship or admiration of others or to the assuaging of guilt, and investments to make us feel that we will be able to buy more of them—than ways of assuaging hunger, thirst, cold, and pain. The point of these virtual games is just to occasion emotions that we supply from the inside, but the games have constraints as substantial as those on getting substantive goods. The constraints are different in nature: There are the pains that come when you excite but do not physically satisfy appetites for food, sex, and some drugs, in addition to the disappointment inherent in not getting an expected pleasure. There are addictive appetites that can be provoked by some fantasies. There are negative emotions that get occasioned along with the positive ones, often, like them, independently of factual rationales—the extreme example being the clinical phobias, which only rarely arise from painful experience with the phobic object.⁴⁵ Most importantly there is the wasting of potential reward caused by suboptimal pacing, a major example of which is procrastination in its subtlest form.

The requirements for pacing emotional reward are introspectively familiar, and well predicted by hyperbolic discounting, but its analysis has been hindered by two oddities in conventional motivational theory that have received little attention-- Call them the problem of pain and the problem of pleasure. I will summarize an exposition made elsewhere:⁴⁶

The problem of pain is how aversive events and their prospect can lure attention but deter motor behavior. Conventional theory says that attention to aversive events is hardwired, a kind of reflex, and attention to their prospect is a conditioned reflex. But alternatives to experiencing fear and pain can often compete with them on the basis of reward, for instance during sports or combat, or even routine daily activities, the absence of which leaves you vulnerable when you are trying to go to sleep; and not entering into aversive emotions is a learnable skill. Furthermore, all stimuli that can induce conditioning have a

⁴³ Stephen Lynn and Judith Rhue, “Fantasy Proneness: Hypnosis, Developmental Antecedents, and Psychopathology.”

⁴⁴ Stephen Lea and Paul Webley, “Money as Tool, Money as Drug.”

⁴⁵ Arnold Lazarus, “Phobias: Broad-Spectrum Behavioral Views.”; E. J. Murray and F. Foote, “The Origins of Fear of Snakes.”

⁴⁶ George Ainslie, “Breakdown of Will,” pp. 48-70, 161-197, and “Précis of Breakdown of Will.”; only references subsequent to “Breakdown of Will” will be given here.

motivational valence as well, an association which is unlikely to be mere coincidence. However, theoretical attempts to make all mental selection depend on motivation have been stymied by the problem of how to attract attention with a negative valence. An unmotivated process such as conditioning has seemed necessary. Hyperbolic discount curves offer a solution: Just as addictive binges are driven by a cycle of temporarily preferred, transient reward and a consequent hangover of nonreward, a more rapid cycle of urges that reduce ongoing reward can drive itches, symptoms of obsessive-compulsive disorder, tics, and other “wanted-but-not-liked” behaviors;⁴⁷ and a still more rapid cycle, more rapid than our flicker-fusion threshold, may let aversive urges be irresistible, for instance to panic or to invite the emotional (protopathic) component of pain, despite an almost instant plunge in reward—“given-in-to-but-not-wanted”.⁴⁸

The problem of pain cannot be solved on a motivational basis without some mixture of reward and nonreward. The cyclical mechanism just described remains speculative, but is consistent not only with hyperbolic discounting but also with recent brain imaging, which has found areas responding to the occurrence of both pleasure and pain but not to their nonoccurrence.⁴⁹ As one neurophysiological commentator has said, “If reward is defined to include all motivating factors, then there may be no differences between attention and expectation of reward”.⁵⁰ The risk of aversive emotions constrains the pacing of emotional reward, not in that some stimulus will impose them on us, but in that either external or internal contingencies will make them partially rewarding, as in the rapid cycle just described.

The problem of pleasure is that positive emotions are clearly accessible without physical stimulation, and can even be trained to occur at will, for instance in actors; but people still depend largely on external events to occasion these emotions. As with aversive emotions, conventional theory invokes an automatic, unmotivated response of emotions to certain innately prepared stimuli, and a transfer of these emotions by conditioning to other stimuli. It has seemed only common sense that pleasure has to be released by external events—otherwise people could sit and reward themselves *ad lib*, short circuiting the adaptive reward contingencies by which the environment motivates behavior. But people do have a great capacity to experience imaginary scenarios emotionally, some “fantasy prone personalities” to a maladaptive degree. The constraint on this process seems to lie not in a limited evocativeness of imagination, but in the decreased emotional impact of a scenario with repetition (which is apparently less in the fantasy-prone). Again hyperbolic discounting suggests a motivational model: To evoke strong, positive emotion, scenarios must include periods of deprivation, in which suspense or longing builds up. A hyperbolic discounter will temporarily prefer lesser, earlier payoffs to the more intense ones that entail initial deprivation, and so will be lured to harvest emotional reward as soon as it becomes even slightly available. She will thus

⁴⁷ See Kent Berridge, “Motivation Concepts in Behavioral Neuroscience.”

⁴⁸ George Ainslie, “Pleasure and Aversion: Challenging the Conventional Dichotomy.”

⁴⁹ Lino Bercerra et. al., “Reward Circuitry Activation by Noxious Thermal Stimuli.”; John O’Doherty, “Reward Representations and Reward-Related Learned in the Human Brain.”

⁵⁰ John Maunsell, “Neuronal Representations of Cognitive State,” p. 264

stay at a high level of satiety, just as someone who feeds herself by continual grazing will not get much pleasure from food. In response to this tendency we learn to cue our emotions by relatively infrequent occasions that are outside our control. Even so, when these occasions recur predictably our attention jumps ahead to their high points, and any suspense component is lost. Since attention cannot be restrained by personal rules,⁵¹ the most effective occasions will have to be surprises. Thus we learn to optimize emotional reward by some form of gambling. To the extent that we gamble on challenging jobs, unpredictable relationships, and even our own creativity, the outcomes reward us more intensely than assured attainments. The motivational constraint on pacing emotional reward arises from our intrinsically poor ability to surprise ourselves.

The ever-present availability of emotional reward creates an obvious potential for procrastination. Cultivating such reward brings continual choices about how to allocate it over time, decisions that must themselves be based on discounted prospective reward, and that are thus subject to temporary preferences for SS over LL indulgences. We know very little about how such choices are made, but hyperbolic discounting may at least help define the problem. The fundamental constraint on mental reward is your capacity to be rewarded in a given modality⁵²—your *appetite* for that reward.⁵³ The occurrence of reward almost always reduces this appetite as it happens.⁵⁴ The combination of reward and using up your appetite in that modality can be called the *consumption* of reward. Most consumption patterns use up appetite faster than it regenerates. Activity in a modality thus tends to divide into consumption and regeneration phases. In the regeneration phase there is little reward from that source—You have to find other sources while waiting for the potential in this modality to regenerate, which entails some changeover cost whether or not a good alternative is available. Even when the return from consumption is all but exhausted, a hyperbolic preference for small, immediate over larger, delayed amounts of reward creates a temptation to defer the regeneration phase. That is, the cost of a mental reward is the wait for its regeneration; deferring that cost in return for inferior current reward is procrastination.

⁵¹ Monitoring a rule not to think about X entails thinking about X. See Daniel Wegner, “White Bears and Other Unwanted Thoughts.”

⁵² A modality comprises the varieties of reward that satiate together. Meat and cheese are in the same modality; meat and water are not. There are an unknown number of modalities that satiate separately (Richard Herrnstein, “The Evolution of Behaviorism.”), and the divisions may be only partial: You can still have an appetite for sugar when satiated for cheese, although both also contribute to a common satiety. Divisions among purely emotional rewards are even less clear. Satiation with comedy may leave some appetite for tragedy, but the underlying substrates that define such modalities are almost entirely unknown.

⁵³ More strictly speaking, your *capacity* for appetite, or “drive.” (See George Ainslie, “Breakdown of Will,” p. 166).

⁵⁴ The only exceptions to have evolved seem to be the brief rewards that command your attention to pain or panic, which lead to sufficient aversion (obligatory nonreward) that they are not in danger of keeping your behavior fixated on repeating them; but even aversive stimuli have some tendency to habituate with repetition

The most concrete example is the choice of bedtime. For many people (perhaps all young children and most college students) it always feels better to stay up a little longer, until well past what, in the longer view, is the optimal time. Putting off sleep now often means going through tomorrow without enough rest, and bitter resolutions in the morning to stop staying up so late. Choices about timing are also evident in the consumption of fiction. We learn in childhood that daydreams habituate, even after we have learned to prevent premature satiety by inventing challenges to be overcome. Surprise must be supplied by another person, such as the author of a book, and we make rules not to cheat on the pacing she supplies by reading ahead. Still, some styles of fiction require more patience than others, and offer greater long range impact in return for their greater short range cost. In buying fiction, and creating it for sale, there are choices about how frequently to have emotional payoffs occur. Over the last century more frequent paces seem to have increasingly won out over less frequent ones, so that older plays seem slow; and publishers require books to have an increasingly high flip value, the frequency with which emotional payoffs occur from page to page. Conversely, audiences hedge their gambles on satisfaction for their next few hours by relying on the predictability of a style, an author, or a performer—thus often settling for a familiar but somewhat habituated work over a greater gamble. Eventually any of these may become so stale that we are driven to search for untried sources; but until then we are apt to fall into this form of procrastination.⁵⁵

To some extent the same conflict between SS emotional rewards and LL ones affects our construction of beliefs as well as our make-believe. Events that we really expect to happen have potentially more pacing power than fictions, because we cannot arbitrarily substitute one expectation for another—or at least must not catch ourselves doing so. In the short run—over hours or minutes, or certainly seconds—we may be inescapably motivated to prepare for them: to become tense and vigilant when we expect danger, to thrill to breaking good news, or to wince as we fall toward a cold lake. However, more distant events are subject to interpretation. Here we are tempted to authenticate the most desirable scenarios as predictable; but abject surrender to this temptation would make our expectations no better emotional pacing patterns than fictions are, just wishful thinking by which we prematurely satiate our appetites. (Of course this cost is in addition to the eventual disappointment of unrealistic hopes.) We learn early to subject expectations to conventions, personal rules. “Testing reality,” as the psychotherapists say, produces a limited set of expectations that somewhat prevent us from putting off the lean, boring experiences that restore appetite. However, even defensibly realistic expectations permit evasions. It may be possible to believe an investment has hope until you actually sell it, leading to the sunk cost fallacy. You may enjoy feeling the possession of money until

⁵⁵ Since risk is required for emotional renewal, this procrastination could also be classed as risk aversion, but putting off necessary renewal should be distinguished from the usual application of this term. Conventional risk aversion is a way of defending wealth, and is often rational—Because your wealth is finite but opportunities for gain are infinite, the value of a potential loss should not be the symmetrical opposite of the value of a potential gain.

you actually pay bills with it, a consideration that leads to irrational delays. You can somewhat expect each of two or more incompatible goals to be realized until you commit yourself to one of them, fostering indecisiveness. And you can believe that the infinitesimal chance of winning the grand lottery is *possible*, and thus in a different category from a pure daydream. The conflicting motives of currently consuming reward versus building appetite shape rules for testing reality that differ among individuals in their permissiveness toward wishful thinking. These differences have never been analyzed, but might be said to loosely correspond to the conventions for writing fiction that are shaped by the same conflict—on a continuum from naturalistic to realistic to somewhat contrived (“well-made,” in the case of plays) to farce. Expectations must compete with possibilities and even outright fantasies according to the same determinants of current rewardingness,⁵⁶ which include the incentive to put off the less productive parts.

Conclusion

Procrastination is one aspect of the universal tendency to discount future events hyperbolically. Temporary preference for accelerating benefits is called impulsiveness; temporary preference for deferring costs is called procrastination. Procrastination is the “tragedy” half of “tragedy tomorrow, comedy tonight.” Although the timing of benefits and costs are just flip sides of the same phenomenon, focusing on people’s preference to defer costs lets us realize how pervasive the phenomenon is. What we call impulses are often intensely rewarding choices such as getting a thrill or consuming an addictive substance, giving intuitive appeal to the suggestion that they win out because of a special, “visceral” quality.⁵⁷ Procrastination, by contrast, may offer very little reward up front, and win out just because the prospect of effort or deprivation feels better if deferred. Here, plain and simple, we can see the warp in the way we experience the future. And while conspicuous temptations can be identified and subjected to personal rules, a preference for deferring effort, discomfort, or boredom can never be entirely controlled. It is as fundamental as the shape of time, and could well be called the basic impulse.

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⁵⁶ See also George Ainslie, “Motivation Must be Momentary.”

⁵⁷ See George Ainslie, “Hyperbolic Discounting Versus Conditioning and Framing as the Core Process in Addictions and Other Impulses.”; David Liabson, “A Cue-Theory of Consumption.”; George Loewenstein, “Out of Conrol.”

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