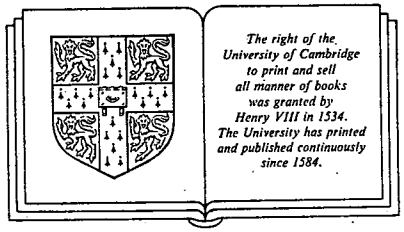
Edited by Jon Elster

THE MULTIPLE SELF



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6. Beyond microeconomics. Conflict among interests in a multiple self as a determinant of value*

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Since ancient times people have tried to understand the nature of value, that is, how events motivate us. Two kinds of good have been described: what might be called visceral satisfactions, closely associated with the consumption of a concrete object and usually in the service of an obvious biological need; and more subtle satisfactions, such as knowledge of 'the ideal' (Plato), pursuit of wisdom (Aquinas), 'the good will' (Kant) or self-actualization (Maslow). Human behaviour towards concrete goods has been by far the easier subject to study systematically. Subtle goods defy precise characterization, and so have often seemed to be irrational or at least to be members of a different motivational system than the one people use to evaluate concrete goods.

Value in economics

Quantitative description of the value of concrete objects became the science of economics. By restricting its attention to goods that trade in a cash market, this discipline has been able to describe striking regularities in how we value these goods. It has created a nucleus of well-articulated rules for understanding value. However, this restriction of attention has had a distorting effect. The territory of monetary transactions has sometimes become disconnected from the broad realm of human choice. Money has often been spoken about as 'behaving' in various ways, almost as if it had a life outside the minds of its owners. For all the usefulness that this analytic fiction may have had, it has tended to create a self-contained body of procedures

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without reference to the human motivational processes that actually determine value.

There has always been dissatisfaction with this insular approach to economics. Early economists looked for broader sources from which the power of money might be derived: gold, land, labour. Recently economists have taken increasing notice of the people who spend the money, and have developed means of studying individual households – 'microeconomics'. Bargaining theory has arisen to study the precise ways prices are agreed on, and the spending decisions of individual subjects are studied using real and hypothetical games. It has even been noted that people's behaviour towards unpriced objects, still concrete but removed from the market for one reason or another, resembles their behaviour towards market goods and can sometimes be studied in a similar way. For instance, Gary Becker (1976) has shown that such diverse activities as marriage, prostitution and burglary follow the rationality described by economic laws.

However, as economics examines individual human behaviours more closely, it discovers examples of apparent irrationality that are not accounted for by existing theory. This is true even of purely monetary transactions. For instance, people value sunk costs more than the equivalent opportunity costs, and in experimental gambling situations frequently do not maximize expected value (Thaler 1980; Tversky and Kahneman 1981). In the real world, of course, any gambling reduces one's expected income, and yet gambling is a popular activity.

Gambling may even become an addiction, a circumstance that raises even harder conceptual questions. The victim of an addiction reports himself to be trapped in a consumption pattern which he wants to abandon but cannot. Although some of his behaviour can be described in conventional economic terms, for instance as the combination of an inelastic demand curve for the addictive good with an increasing price for that good (Stigler and Becker 1977), the simultaneous existence of a demand curve for *avoiding* the good requires special treatment.[1]

Most troublesome of all are the examples where contingencies of

[1] Winston (1980) has offered a formal solution to this particular problem – two competing, independent consumption patterns. However, once economics has recognized more than one consumer within the individual, it must specify some rules for how these consumers interact.

concrete reward simply fail to control choice. Sometimes this is only because such contingencies have blind spots, where the attitudes and practices Leibenstein (1976) described as 'X-inefficiency' can flourish without penalty. Often, however, there is evidence that the subtle kind of rewards earlier described only by philosophers have become a factor in the marketplace. Looking not only at people's life strategies broadly (Scitovsky 1976) but also at workers' motives to perform on the job (Levinson 1973) economists are becoming aware of the importance of non-concrete, often non-purchasable rewards. There is more and more reason to re-connect economics with other approaches to human choice-making, in the hope of finding ways to rationalize what now seems irrational.

Value in psychology

Unfortunately, the psychological study of motivation has paralleled rather than complemented the economic one. Concrete rewards have been studied thoroughly, but this nucleus of knowledge has not been successfully expanded to include the subtle rewards.

The study of concrete rewards has produced a wealth of quantitative detail about how reinforcement (the internal mechanism of reward) depends on previous deprivation, rate of delivery, the presence or absence of other sources of reinforcement, etc. However, in a prosperous society, most behaviour is not motivated by literal biological needs. Most of our activity is rewarded by emotional processes that are occasioned by other people's social responses, or by tasks or games which are rewarding in their own right. It would clearly be desirable if these subtle reward factors could be understood in the same framework as visceral ones, but psychology has had difficulty bridging the gap.

One approach has been to make classical conditioning ('learning by association') the bridging mechanism. For instance, the rewarding value of an intangible reward like fame might be attributed to an infantile association between getting attention and getting food, thus in effect backing the soft currency of an activity reward with the hard currency of a visceral reward (Miller and Dollard 1941). However, observation has not traced and perhaps cannot trace such tortuous paths of association. Such derivations strain credulity, and in any case

there is no reason to expect that the conditioned rewards should remain powerful once the person has discovered direct ways of getting the original visceral reward. The person who is not hungry should stop valuing the conditioned food stimulus, attention.

More recently, psychologists have argued that there are elementary drives for the game-like rewards (Fowler 1967; Hunt 1963). The problem with their exploration, curiosity and mastery drives, and with the related concept of maintaining an optimal level of arousal, is that the properties of the situation needed to satisfy the drive are hard to specify. In general, objects with moderate degrees of complexity, as opposed to very high or very low degrees, have been found to be the most desirable as objects of attention (Berlyne 1971; Chevrier and Delorme 1980); but the correlation with desirability has been only approximate, and important questions about what limits satisfaction from this kind of activity have not been answered. The attempt to predict higher motives from this kind of elementary drive was pronounced a failure by Coombs and Avrunin (1977).

Discouraged in the attempt to account for subtle motives with simple principles, psychologists have recently turned to the same kind of 'shopping list' concept of reward that economists use: 'That which a person will pay money for is a good.' For instance, David Premack (1959) has pointed out that activities the person will indulge in frequently when free to do so can be used as rewards for activities he ordinarily performs less frequently. There is still argument as to the proper form of this principle (Timberlake 1980), but its effect has clearly been to pull motivational psychology out from inside the individual subject, making it something like a branch of microeconomics.

The blind, functional definition of reward runs into the same problem in psychology that the simple marketplace model has encountered in economics: people often fail to maximize any shopping list of goods, but rather behave in ways that look internally contradictory. At least seven such problems can be defined:

Problem 1. Many rewards seem to function simultaneously or in close succession as both rewards and punishments. For instance, a person may in the same day or at the same instant both pay for cigarettes and pay for a smoking cure. Such conflictual rewards utterly defeat the Premack strategy of functional definition.

Problem 2. Even harder to understand is human abstemiousness in areas where we are freely able to reward ourselves. The emotions which we hope to have in our human relationships, and which we pay to experience in a play or movie, are nothing we cannot generate on our own, just by thinking about the appropriate subject. Some researchers have taken the trouble to demonstrate this ability under controlled conditions (Koriat *et al.* 1972; Lazarus 1975a and b), but it is familiar enough. Why do we wait for other people to congratulate us rather than arbitrarily congratulating ourselves, a behaviour that is certainly in our repertoires? Why is a book better than a daydream, sexual intercourse better than masturbation, or a back rub better than a back-scratcher? Under hypnosis, which is the directed concentration of attention, people can enjoy virtually any familiar reward. Many people can learn to hypnotize themselves, but they subsequently have little or no tendency to spend their time coining such rewards. What process can it be that keeps most of us from becoming autistically self-absorbed, and why should it be an unhappy fate when this protective process fails?

Problem 3. The events that can serve as rewards are changeable: an object which is highly desirable to a person or to a whole society in one time period may be worthless in the next (see Stigler and Becker 1977 for an economic exploration of the problem of fashion). Thus the scientist cannot simply observe what has been rewarding and assume that it will continue to be so. Even goods which are widely regarded as rock-hard reinforcers – food, sex, aggression, life itself – not infrequently lose their motivating power. In anorexia nervosa a physically healthy person may voluntarily starve to death; in sexual frigidity, the chance for sexual activity may become actually disgusting; many people develop a similar disgust for anger; and more than 1 per cent of deaths are suicides.

Problem 4. Many apparent rewards cannot be produced by direct effort. These are the states which usually occur as by-products, like sleep, laughter, happiness, and dignity, and which are lost in any systematic attempt to attain them (well defined and discussed at length in Elster 1981). Such states may be highly valued, but how can they be called operant reinforcers if they lack a behaviour to reinforce?

Problem 5. As has been mentioned already, people often fail to maximize their expected incomes or minimize their costs; this

behaviour is characteristic of some individuals, and a temporary pattern for others. The difference in importance that various people give to money is notorious. Some people think about it constantly and analyse most of their decisions in terms of it. Some people seem fundamentally unable or unwilling to think economically and are forever buying irrationally, giving capriciously, etc. Not only are there individual differences, but seemingly irrational considerations regularly alter the value of money from time to time in the same person. The value of an amount of money, as measured by its tendency to be chosen, seems to be significantly affected by such circumstances as the terms in which it is presented to the person (Wasson 1975), whether it represents a gain or an avoided loss (Tversky and Kahneman 1981), whether the person already has money at stake (Thaler 1980) and whether or not the current choice is an obvious example of a larger set of choices (see below). Why should these seemingly valueless factors have such an impact on choice?

Problem 6. The converse of the problem of how people abstain from self-reward is that of why people consent to undergo pain. Attention is now understood to be a motivated response (Moray 1969) so that attention to painful stimuli requires motivation (Ainslie, forthcoming). Under many circumstances pain cannot in fact compete for the person's attention: soldiers preoccupied by battle frequently do not feel their wounds, hypnotic subjects may undergo major surgery while merely directing their attention voluntarily from the pain, expectant mothers may learn attention-directing exercises to greatly reduce the pain of labour and dentists find that trivial distracting stimuli reduce the pain of dental procedures (Beecher 1959, pp. 157–90; Melzack *et al.* 1963; Sternbach 1968, pp. 140–1). How does nature induce people to take an interest in their pains and other aversive stimuli in such a free market as this?

Problem 7. Finally, quantitative study of the function by which rewards lose their power with delay have shown it to be very steep (Renner 1964), even in man. For instance, both normal and impulsive human subjects, reporting how long they would wait to get double a hypothetical prize, usually generate answers reflecting annual discount rates in the billions, trillions, or quadrillions of per cent; and a large proportion of adult human subjects who could wait 3 days to receive 25 per cent higher subject pay chose not to do so, a choice which

represents rejection of an annual 5 billion per cent interest rate (Ainslie and Haendel 1982). How may we reconcile this finding with the widespread savings ethic? What would even give primitive farmers a sufficient savings tendency to get through the winter?

Intra-personal bargaining

It may be that economics and psychology must stop at the boundaries of the individual subject – that he must be regarded as a black box, and that his idiosyncrasies can only be catalogued as well as possible and added as epicycles to the rational model of economic man. However, some recent findings in behavioural psychology suggest a way to go beyond microeconomics by defining durable interests within the individual person. These interests, in their dealings with each other, follow some of the rules of interpersonal bargaining, and may provide a systematic explanation for the phenomena just listed.

It is not a new idea that the self is multiple. Philosophers and psychologists since Plato have described competing principles of decision-making, usually a lower, impulsive principle and a higher, rational principle (Kenny 1963, Ch. 8; Kant 1960, pp. 15–49; Ricoeur 1971, p. 11; Freud 1923); but the relationship between these principles has been elusive. If the parts of the self can be clearly articulated, they may be suitable material for a model more microscopic than microeconomics, 'picoeconomics' perhaps, in which the elements that combine to determine the individual person's values can be described. Freud proposed such an economic model and kept it in mind as he modelled motivational conflicts, but he never achieved a coherent system (1916–17, pp. 356–7). This chapter will present some preliminary suggestions about how a multiple self may be simply described.

I will argue that problem 7 contains not only its own solution but a practical approach to the first six. This solution is apt to be counter-intuitive, since it relies on the fact that the curve describing how people discount delayed rewards is warped: not only steep, but markedly bowed downwards. Carrying this observation to its logical conclusions may seem unnatural. We do not like to think of our world as being curved: people resisted the Greeks' deduction that the world was round until Magellan made the conclusion inescapable, and we have

been equally queasy in modern times about the curves that relativistic physics has introduced into our space and time. Nevertheless, the concept of a highly concave discount curve is not only supported unanimously by the available evidence, but is most useful in understanding 'irrationality'.[2]

Temporary changes of preference

Two decades ago, Richard Herrnstein (1961) proposed his matching law, a formula which summarized the choices animals made on concurrent variable interval schedules. This formula was parsimonious in the extreme, containing no empirical constants:

$$\frac{B_1}{B_2} = \frac{R_1}{R_2} \times \frac{A_1}{A_2} \times \frac{D_2}{D_1}$$

where B_1 and B_2 are the amount of time spent in each of two alternative behaviours, and the Rs, As and Ds are the rates, amounts and delays of the consequences of these behaviours. A variety of subsequent experiments have found this formula to give the best least-squares fit of preference data in animal and human subjects (deVilliers and Herrnstein 1976). For our purposes, its major prediction is that preference for a reward will be inversely proportional to the delay of that reward from the moment of choice, a function that can be graphed as a hyperbola. Delay has its effect independently of rate and amount. Its inverse is multiplied by them to obtain actual value. This value declines steeply in the range of delays close to zero, a behaviour that fits the experimental findings just described; but it levels out into a long tail at long delays, a property which, as we shall see, produces a contrary tendency towards 'objective' valuation of rewards.

Subsequent experiments have suggested that the original matching law is not the last word on discounting reward. Some predictions it makes have not held up; for instance, alternative rewards delayed by the same amount from the moment of choice should be preferred in the same proportion whatever that delay is, but in fact preference for the larger reward increases as the delay increases (Navarick and Fantino 1976). It also does not account for individual variations observed in the

[2] This argument has been developed more fully in Ainslie (1982).

tendency to discount delayed rewards, an observation which has led Herrnstein (1981) to add an empirical constant. Furthermore, the matching law may be only a corollary to more fundamental laws only partially discovered; its predictions with respect to rate of reward, which have been the ones best validated, can be predicted by a more fundamental kinetic equation (Myerson and Miezin 1980).

However, the aspect of the matching law which is important to our discussion of value does not depend on its precise shape. It requires only that the discount curve of delayed rewards be more bowed than the standard per-cent-per-unit-time (exponential) curve by which ordinary interest and discount rates are calculated. Exponential curves drawn from rewards of different sizes at different delays will never cross one another if they have the same time constant (as in Fig. 1). Their relative heights, describing the adjusted values of the rewards from which they are drawn at any particular time, will be the same at every moment. With more concave curves, however, there will be some pairs of alternative rewards such that a larger, later reward is

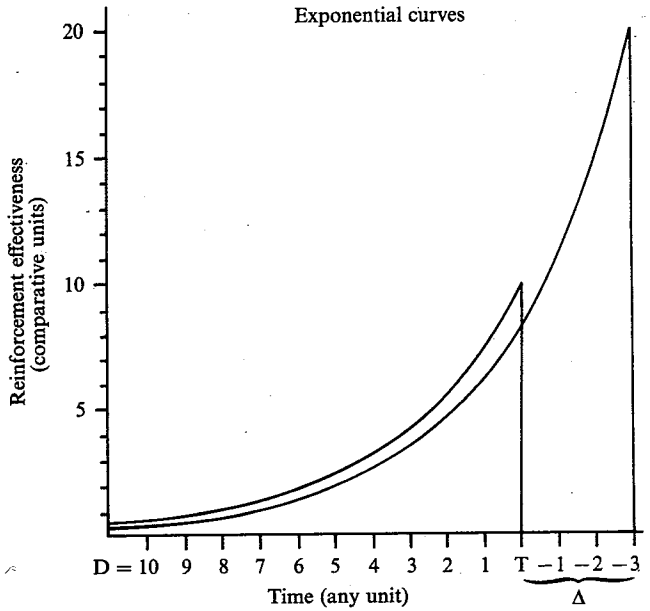


Fig. 1. Exponential curves of the effectiveness of a reward available at time T and an alternative which is objectively twice as great, available three units of time later, as a function of decreasing delay before they become available.

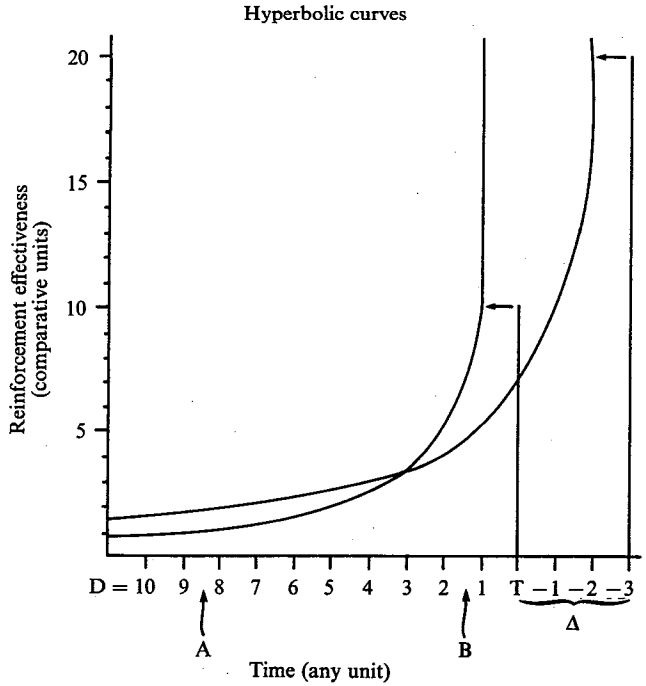


Fig. 2. Hyperbolic curves of the effectiveness of the same alternative rewards, available at the same times as in Fig. 1. Note that predicted preference changes between time A and time B. As delays become minuscule, effectiveness becomes enormous, making objective size unimportant.

preferred when the choice is seen from a distance, but the smaller, earlier reward is preferred as it becomes imminent (e.g. Fig. 2). This temporary change of preference is predicted not only by the matching law but by various other hypothetical curves, some of which are supported by data (e.g., Logan 1965). But it is not necessary even to know the shape of the delay function; temporary changes of preference can be looked for directly.

In the experimental paradigm to elicit temporary change of preference, a reward is made available at time T, and a larger, alternative reward at time T + Δ. With Δ held constant, the delay (D) before T at which the choice is made is varied parametrically. A switch of choice from the larger, later to the smaller, earlier alternative as D becomes smaller represents the temporary change of preference that is important for the study of value. Such temporary change of preference has

been obtained in animals (Rachlin and Green 1972; Navarick and Fantino 1976; Ainslie and Herrnstein 1981); in undergraduates choosing between longer or shorter periods of relief from noxious noise (Solnick *et al.* 1980); in substance abuse patients choosing between different amounts of real money (Ainslie and Haendel 1982); and even in the conscious self-reports of various human subjects choosing between hypothetical amounts of money (Ainslie and Haendel 1982). For instance, most people say they would rather have a prize of a $100 certified cheque available immediately rather than a $200 certified cheque that could not be cashed for 2 years, but do not prefer a $100 certified cheque that could be cashed in 6 years to a $200 certified cheque that could be cashed in 8 years, even though this is the same choice seen at 6 years' greater delay (D).[3]

Intra-personal interests

Temporary preference for inferior alternatives during the time they are imminently available seems to be a universal feature of the way we perceive delay. Its obvious consequence is the creation of two distinct interests in many choice situations: a short-term interest based on the proximity of a poorer reward, and a long-term interest based on the 'objective' sizes of the alternative rewards. The long-term interest is based on heavily discounted incentives but has the advantage of foresight – it can take steps in advance to forestall the temporary change of preference towards the poorer alternative, like Ulysses tying himself to the mast.[4] The short-term interest is powerfully motivated and can be expected to prevail if it has not been forestalled in advance. These two interests will tend not to come into equilibrium with each other, that is, not be weighed against each other to produce a simple preference, because they are dominant at separate times.

It is these interests, based on alternative rewards and motivated by their temporal relationships to act upon one another, that would be the choice-making agents in a picoeconomic approach. I will argue that the moves they are motivated to make can be expected to generate the

[3] These normal subjects generally do not notice that these choices differ only in the time they are made, and cannot give a rational explanation of their reported intention to change their choice when this is pointed out to them.

[4] This comparison was first suggested by Strotz (1956), and is explored in detail by Elster (1979).

otherwise paradoxical phenomena listed above. For instance, the spontaneous preference not to save at an enormous interest rate, by subjects without apparent problems in the area of compulsive spending (problem 7, above), may be seen as an example where subjects' short-term interests are not forestalled by their long-term interest. Why this might be true some but not all of the time depends on the properties of the precommitting devices open to the long-term interest.

Precommitting devices

Psychologists have long had an intuitive awareness of the need for long-term interests to forestall the temporary dominance of competing short-term interests, and have discussed the means by which they do so under the name of defence mechanisms or coping mechanisms. As described by the literature of ego psychology, behaviour therapy and self-help, these mechanisms follow one or more of four distinct strategies (Ainslie 1982).

1. Extrapsychic devices. People may set up physical or social constraints to limit their future range of choice. Such devices include taking pills to change appetitite, locking up temptations or moving away from them, asking friends or parents for supervision, making public promises to avoid temptation or getting themselves locked up. Psychoanalytic writers refer to some of these devices as 'asking for controls'.

2. Control of attention. People may keep the opportunity to behave impulsively out of sight or out of mind, so that they cannot receive or process the information that the inferior reward is at hand. For instance, an overeater may keep food out of sight or keep busy so as not to think about food. Behaviour therapists have referred to similar activities as 'stimulus control' (Kanfer and Phillips 1970; Goldiamond 1965), and psychoanalysts have called them suppression, repression or denial.

3. Control of emotion. People may use the self-perpetuating quality of affects to influence their motivational state in the near future. One

can cultivate an emotional process that is incompatible with an impulse one fears; the person who is afraid of getting too angry may cultivate loving feelings, and the person who is afraid of being seduced may start a quarrel. Behaviour therapists have described 'coverants' that function this way (Homme 1966), and psychoanalysts have called this process reversal of affect or reaction formation. Conversely, a person may nip in the bud emotions that increase the likelihood of impulses, maintaining an attitude of neutrality that is sometimes called isolation of affect. Anger and love will not overwhelm the person who is not emotionally involved to begin with.

4. Private rules. People may make private rules that group their temptations into sets, so that each choice involving a temptation becomes a precedent predicting all their future choices within the set. By this perceptual change, they are able to stake their expectation of reaching some major goal against each small step in the wrong direction (Ainslie 1975). For instance, an overeater can adopt a diet which each act of eating must either violate or not; thereafter any act of overeating will lead not only to a small gain in weight but to a major fall in the person's expectation that he would stick to his diet in the future. This tactic of staking the credibility of a long-term goal on each choice that threatens it has been described as will-power, acting on principle, making promises to the self, and beta control (Kanfer and Karoly 1972). It does not correspond to any single psychodynamic defence mechanism, but seems to be at the heart of what are called 'compulsive controls' (Ainslie 1984).

Making private rules is a side-betting tactic familiar to bargaining theorists. Schelling (1960, p. 30) describes the position of a bargainer who must face an opponent in repeated transactions: 'If I conceded to you here, you would revise your estimate of me in our other negotiations. To protect my reputation with you, I must stand firm.' In effect, the value of the series of future transactions forms a 'kitty' which both sides can see to be at stake in each current transaction. Similarly, the person making a private rule tests the rule against each successive temptation. If he goes off his diet, or takes his first drink or breaks his budget this time he will lose his expectation of following his rule in the long run, since it was this expectation that formed the 'kitty' of the bet: the next time he faces the same temptation he will have that much less

weighed against it and so will be even more apt to give in. This effect is most palpable in the case of the alcoholic trying to avoid drinking, where the force of temptation after the first drink is so strong that it is called a 'loss of control', and for a long time was falsely thought to have a reflexive basis (Marlatt 1978).

This fourth strategy, making private rules, seems to be the most effective means of precommitment, and it will be the most useful in understanding the seeming irrationalities mentioned above.

Bright lines

The implementation of private rules depends a great deal on the availability of external criteria for their application. Facts that are outside of the person's control can act as truce lines between his long- and short-term interests. Again, Schelling provides a succinct analogy:

> Two opposing forces are at the points marked X and Y in a map similar to the one [in Fig. 3]. The commander of each force wishes to occupy as much of the area as he can and knows the other does too. But each commander wishes to avoid an armed clash and knows the other does too. Each must send forth his troops with orders to take up a designated line and to fight if opposed. Once the troops are dispatched, the outcome depends only on the lines that the two commanders have ordered their troops to occupy. If the lines overlap, the troops will be assumed to meet and fight, to the disadvantage of both sides. If the troops take up positions that leave any appreciable space unoccupied between them, the situation will be assumed 'unstable' and a clash inevitable. Only if the troops are ordered to occupy identical lines or lines that leave virtually no unoccupied space between them will a clash be avoided. In that case, each side obtains successfully the area it occupies, the advantage going to the side that has the most valuable area in terms of land and facilities. (1960, p. 62)

Schelling goes on to argue that the only good solution for each commander is to order his troops up to the river. The river has no military value *per se*, but it is the only boundary that stands out from other possible boundaries, and each commander should assume that that is what the other is looking for.

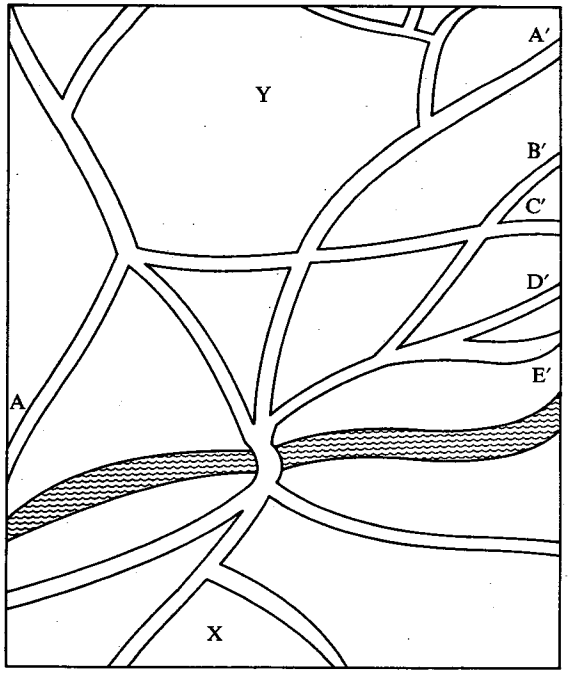


Fig. 3. Map of hypothetical terrain, explained in text (from Schelling 1960).

In the case of private rule-making, the problem is not one of blocked communication but of leaderless troops, say on the X side, who share a common interest in holding ground for their side but who have an individual urge to flee. These troops represent successive motivational states in an individual person, which are individually lured in the X direction by temptation but are less likely to succumb if doing so will end the general resistance to the temptation. Temptation is greatest the furthest one goes in the Y direction. At each choice the person picks a position he thinks he will be motivated to maintain in the future, say along line A–B′. He gives up on positions on the Y side of this line as posing irresistible temptations, a self-confirming prediction. At his chosen line he is somewhat protected from succumbing by the fact that his holding or failing to hold the line represents a precedent, which he will recall at all subsequent choices. A lapse would have much the same effect as a soldier running away: the other soldiers would follow him and the line would crumble.

When a choice is not a precedent, a lapse does not threaten the larger series of choices; thus, it is in the person's short-term interest to distinguish the choice at hand from the larger category, so that the person can both indulge in the temporarily preferred alternative and keep an expectation of obeying his rule generally. That is, under the pressure of temptation the person might not simply retreat from his chosen boundary, for example, line A–B′, but call for a specific retreat to line A–C′; in doing so he abandons the attempt to follow his long-term interest in any cases contained in the sector A–B′–C′, and must hope that this retreat does not cause a more general retreat, for example, to the river.

William James provides a classic description of this process in an alcoholic defining the line between forbidden and permissible drinks:

> How many excuses does the drunkard find when each new temptation comes! It is a new brand of liquor which the interests of intellectual culture in such matters oblige him to test; moreover, it is poured out and it is a sin to waste it; or others are drinking and it would be churlishness to refuse; or it is but to enable him to sleep, or just to get through this job of work; or it isn't drinking, it is because he feels so cold; or it is Christmas day: or it is a means of stimulating him to make a more powerful resolution in favor of abstinence than any he has hitherto made; or it is just this once, and once doesn't count, etc., etc., *ad libitum* – it is, in fact, anything you like except *being a drunkard. That* is the conception that will not stay before the poor soul's attention. But if he once gets able to pick out that way of conceiving, from all the other possible ways of conceiving the various opportunities which occur, if through thick and thin he holds to it that this is being a drunkard and is nothing else, he is not likely to remain one long. The effort by which he succeeds in keeping the right *name* unwaveringly present to his mind proves to be his saving moral act. (James 1890, p. 565)

James is pointing out that if the person believes he can get away with loopholes, he may find so many that his rule becomes worthless. If he does *not* believe this, he can probably hold the line.

In any given choice, the person's long-term interest is to say, 'It's a matter of principle', while the short-term interest proposes, 'Just this once.' If the person expects the proposed exception to produce a greater rise in imminent reward than a fall in (discounted, delayed) aggregate reward, it will succeed and in all probability be institutionalized as a loophole: 'I always get drunk on New Year's Eve', or 'We mustn't stint expenses on Johnny's birthday.' A rare windfall like a game-show prize or one's earnings as an experimental subject, the rewards so steeply discounted in problem 7, are in a prime position to become exceptions to the person's usual rules of thrift.

The availability of boundaries which cannot be moved just a little bit is very important to the long-term interest. Activities like smoking and drinking have such a line in an obvious place, that is, between any indulgence and no indulgence; but people who eat too much or spend too much money cannot completely give up these activities, and so must find some way to make a single diet, or budget, stand out from all the others to which they are apt to retreat under pressure. Lawyers call such a unique boundary a 'bright line'. The concept is familiar to people whose profession it is to negotiate between interests in the larger world. It expresses why countries blessed with unique boundaries like a mountain range or a river without large tributaries have fewer wars than countries just set out on a plain.

How the conflict of interests creates seeming irrationality

The basis for a durable ambivalence between larger, later and smaller, earlier rewards should now be apparent. A person's short-term interest in smoking a cigarette may take turns indefinitely with his interest to obtain a smoking cure (see above, problem 1). In a bargaining situation brought about by his use of private rules, he might even want the two alternatives simultaneously: a cigarette just this once to be followed by abstention ever afterwards, a deal which, if credible, would be acceptable to both his long- and short-term interests.

Constraints on self-reward

This intra-personal bargaining model is important to the problem of self-reward because it applies not only to the choice of competing rewards like drink vs. sobriety, but also to alternative rates of consuming the same reward. As was noted in problem 2, it does not seem to be

difficult to short-circuit the 'normal' dependency of rewards on external events. Insofar as emotions, the main rewards in humans, are within each person's power to evoke in himself, the question must be asked: why don't people become totally involved in rewarding themselves? What would happen if someone decided to become self-sufficient, and to reward himself without regard to environmental input?

Freud believed that infants had just such omnipotence (1900, p. 598; 1915, p. 135). He said that the 'demands of reality' ended their self-sufficiency; but if he meant the threat of starvation he was certainly not referring literally to modern society. In fact, young children reduce their fantasy lives gradually, not because their parents and teachers beat them into line but because their fantasy becomes relatively less satisfying and fails to compete with other forms of play.

Further observations come from two kinds of psychiatric patients who try to bring their sources of reward into their own hands by withdrawing their investment in chancy activities: schizoid characters feel threatened by social give-and-take and often contrive to live entirely in their rooms, or in a cabin in the woods. Insofar as they succeed in doing this, their solitary activities mysteriously become stale, and they often fall prey to worries, fears or rituals. At a higher level of functioning, narcissistic characters choose their activities and companions so that continual success is a foregone conclusion. They, too, report a mysterious reduction in satisfaction that cannot be accounted for by any confrontation with reality; on the contrary, their problem is that they have managed to get reality to obey them almost as well as their fantasies do. Thus, the harshness of reality does not seem to be the factor that limits arbitrary self-reward. It looks more as though self-reward, indulged in *ad libitum*, becomes unsatisfactory for that reason itself.

The staleness of reward reported by self-absorbed people makes one think of habituation or fatigue. Any neuronal process, if repeated frequently during a short period of time, will lose vigour. For instance, if one stares at a solid colour for any period of time, the visual pigment that subtends that colour will be depleted, so that if one then stares at a neutral screen one will see the complementary colour. Data about the generality of this phenomenon in psychophysiology have been summarized by Solomon (1980), who proposed an increasing recruitment

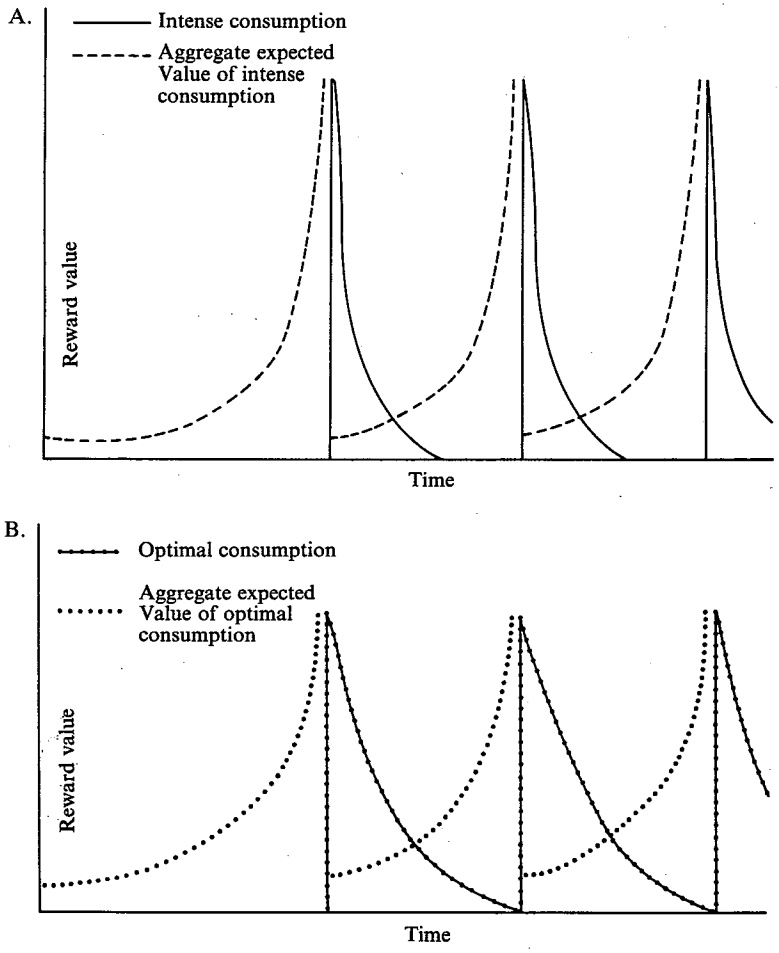
of antagonistic processes as an explanation; but the simple fatigue of the process in question should account for its decreasing ability to compete with its fellows. If the physiology of reinforcement is not an exception, then repeated attempts to invoke a given kind of reward should produce diminishing returns. Even self-reinforcement should be expected to satiate.

It is also important that satiation is not simply proportional to the amount of rewarding activity that has occurred. A person will get more or less satisfaction from a given opportunity for reward (i.e. drive) depending on how he consumes the reward. For instance, a person is less rewarded by a given amount of food if he pays attention to something else while eating, a practice thus forbidden by behaviour therapists of obesity. Likewise, a person would not want to bolt a gourmet meal, but rather space out consumption to take maximum advantage of his available appetite. In fact, the problem of premature satiation is widely noted in other activities as well, from sexual intercourse to the writing and reading of fiction. The writer must not resolve the story's problems too soon, nor the reader peek ahead to the end (other examples in Ainslie 1975). It seems that intense or rapid consumption of a reward often leads to disproportionally rapid satiation, perhaps because some kind of threshold is reached too soon – a phenomenon certainly present in premature orgasm. Thus, within a given reward modality the person faces choices involving the pace at which he will consume the reward. If he maximizes the rapidity with which reward reaches peak intensity, he may reduce rather than increase his aggregate reward.

This situation is shown graphically in Fig. 4. The solid lines depict two possible curves of reinforcement over time, where rate of satiation is proportional to the initial intensity of reinforcement. The choice between intense, brief periods of reward and less intense, more prolonged periods of equal frequency clearly poses the smaller–earlier vs. larger–later reward problem we have just discussed. If the discounted value of every moment of consumption is calculated according to the matching law and added together, and the resulting values plotted for each moment before consumption occurs, the curves (broken lines) favour the slower consumption of reward when the two consumption patterns are viewed at a distance, but temporarily favour the rapid, less productive consumption pattern when it is imminently available.

Highly bowed curves other than the matching law generate the same result: rapid consumption can be an impulse that threatens the most efficient consumption pattern for the reward in question.

Inefficient consumption would not matter if the amount of drive that could enable comparable reward were limitless and could be tapped without delay. Neither of those conditions is apt to be true, however. We do not know how many processes there are that can satiate separately – that is, sources of reward that can remain productive when other sources have fatigued, as when one is hungry but not thirsty. If we had this information, we would be able to count the number of



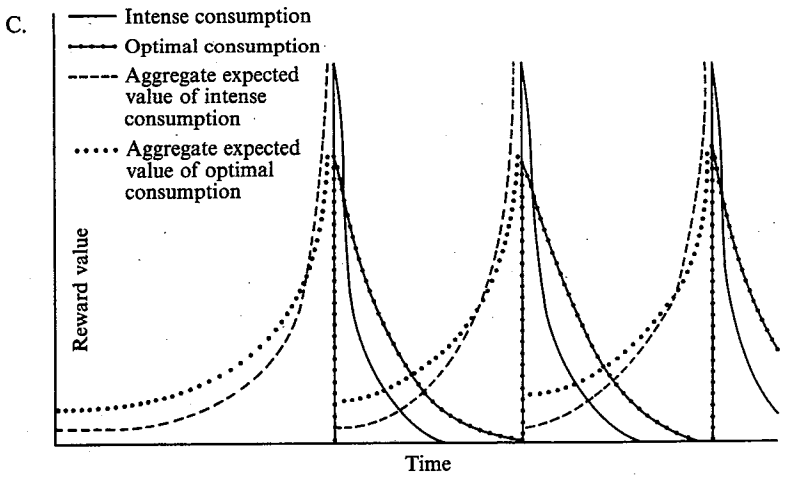


Fig. 4. Two consumption patterns of reward over time (solid lines), and the aggregate value of all remaining moments in each, discounted in hyperbolic curves (broken lines): (A) Rapid, intense consumption; (B) more gradual consumption; (C) the two patterns compared.

separate drives it defined. However, we can deduce that the number must be small for practical purposes from the fact that appetite is so widely regarded as a precious commodity: people not uncommonly work up an appetite for dinner, boast of an appetite for sex, complain of a jaded appetite for entertainment and so on. Furthermore, it seems that to indulge an appetite requires a period of relatively unrewarding setting up: one must change one's interests, 'settle down' to the new task, 'get in the mood', and if one's attention is distracted in the midst of this process, the task must be partially repeated. Distractions have an aversive impact.

For these reasons, inefficient use of available drive will reduce a person's aggregate reward. It will be in his long-term interest to adopt any available precommitting devices that prevent premature satiation. It is not hard to think of concrete devices that seem to serve this purpose: banquets with many courses which pace their consumption, eating lobsters or crabs out of the shell, retarding orgasm with anaesthetic creams, etc. However, these mechanical devices are apt to be of limited availability and usefulness. Against the ultimate temptation – the availability of purely intrapsychic self-reinforcement – such devices would be of no use whatsoever. A really practical device

to prevent premature satiation must tie the person's self-reward behaviour to the occurrence of events outside his control, and it must use purely psychological ties.

But a private rule is just such a device. A person can make a rule to congratulate himself only when he has finished a certain task, or when someone else congratulates him; he may let himself be elated only when a friend is, or only when he wins some kind of prize which is not too easy to get. He can make binding gambles. He can 'invest' importance in a person, or a cause or just a piece of entertainment, so that his self-reward is thereafter tied to the fate of his investment. In Freud's term, he may 'cathect' objects, and if he fails to do so he will be at the mercy of his own natural greed; he will be trapped like King Midas in a sterile omnipotence which might be called narcissism or autism.

The activity of investing objects with importance can be detected under perfectly ordinary circumstances, despite the fact that the investor has usually let the rule grow spontaneously rather than creating it deliberately.[5] For instance, if I have a friend who sometimes drops by and suggests we take a coffee break during the work day, and if he does not come too rarely or too often, I am spared the need to regulate my breaks. If I have to decide arbitrarily when to take a break, I cannot take it whenever I feel ready, for fear the sensation of readiness will come with increasing frequency and make me unable to complete any difficult task. Rather than take the chance of an arbitrary decision, I may go without breaks altogether. But if my rule merely says I can have a break when my friend invites me, and if my friend is a 'good' friend in this respect, my problem is solved.

The same considerations apply to purely mental self-reward. If I reward myself in fantasy arbitrarily, that is, without regard to events outside of my control, my fantasies will slide into premature satiation. At the very least I will have to fantasize enemies to my imaginary goals, who operate according to inexorable rules to restrict my self-rewarding behaviour. In fact, people who dwell extensively in fantasy are usually driven to paranoid scripts to maintain the vigour of their fantasies. For instance, the unreal world of the schizophrenic often evolves from a

[5] See Ainslie (1984) for a discussion of how private rules can grow without the person's being able to report them.

heaven to a hell, a process well depicted in Hannah Green's *I Never Promised You a Rose Garden* (1964).

When I make a rule that my self-reward will hinge on hard facts, my task becomes easier. Such facts may merely be fictions created by someone else: a book or movie is apt to be preferable to my own unrelieved company. A person is not usually conscious of investing importance in a movie, but the existence of this importance is shown in the infrequent case when a movie becomes too punishing and the person withdraws the importance. He says to himself, 'It's only a movie', and yet he is not giving himself new information – he has never ducked when guns pointed towards the audience. Rather he is announcing his disinvestment: 'This movie shall no longer be important to me. I shall no longer reward myself according to its vicissitudes.'

A person can always abandon a rationing device, and is sometimes forced to do so by the unusual strength of a short-term interest or the unwise choice of a device by the long-term interest. However, when this happens the long-term interest is somewhat undermined. The person who withdraws his investment during the scary part of the movie loses his chance to be rewarded by the movie afterwards; to some extent he will lose his ability to keep his investment in subsequent movies when they tempt him to disinvest. The person whose long-term interests combine through the use of private rules thereby stakes more on each choice. Thereafter each competing short-term interest is less apt to prevail, but if it does the disaster to the long-term interest is so much the greater.

If a situation is 'real' rather than fictional it will be more dangerous to disinvest in, even if the person's physical safety is not at risk. There are many fictions that can be chosen, but there is only one reality. If a person abandons that bright line as a criterion for self-reward, he is in danger of autism. Of course, many realities are a matter of interpretation ('Can I expect to be rich?', 'Am I a good guitar player?', 'Is my missing spouse alive?'). The set of beliefs which the person qualifies as real must be protected from inflation by another set of private rules, governing what psychiatrists call 'reality testing'. Like all private rules, they can be hedged by finding loopholes.

In this model of value, the availability of environmental reward is not the limiting factor in the operation of the person's internal

reinforcing mechanism. The limiting factor instead is the availability of discipline, that is, of means of restricting self-reward according to a pattern that makes the best use of the underlying drive. External objects are valued not because they can peremptorily bestow or withhold reward, but rather insofar as they serve as useful boundaries between the person's long-term interest in maximal aggregate reward and his short-term interest in immediate reward. If a private rule can turn upon a particular situation in a way that permits a large amount of self-reward aggregated over time and is not very vulnerable to the competition of brief, intense self-reward patterns, this situation will be valued, for the same reason that Schelling's battle commander valued the river. The person will pay money to obtain it and learn behaviours which increase its availability.

This is the solution to our second problem: how an organism that has an extensive capacity to reinforce itself can take an interest in the outside world. An omnipotent organism has a shortage of scarcity; it needs objects that can maintain appetite if it is to get the greatest possible reward.

Fashion

It is not clear why nature should have selected rationing devices for self-reward as the goods which people will value, rather than a turn-key kind of reward which must always come from outside the person.[6] It can only be said that inventors have often found the most direct solution to a problem to be too rigid; the device that works in practice is often engineered to allow slippage among the parts. Perhaps the constitution of rewards as rationing devices rather than as absolute determinants of reinforcement permits the most flexible adaptation to the environment.

For instance, such a mechanism may motivate maximal environmental exploration over a wide range of success rates, both by the naive youngster and by the experienced problem-solver. If internal

[6] Other animals, too, have been found not to be entirely dominated by concrete rewards. Hungry monkeys have been observed to prefer exploration tasks to tasks which obtained food; and even in lower animals like rats the power of visceral rewards such as food and sexual activity are modified by factors like variety, which are wholly unnecessary to the physical consumption of those rewards (Fisher 1962; Wilson, Kuehn and Beach 1963; Walker and King 1962).

reinforcement were strictly proportional to the amount of some external stimulus, a proportion sufficient to shape behaviour in a beginner might lead more advanced problem-solvers to rest on their laurels. But instead, as a person becomes increasingly skilled in an activity, this activity is apt to become more rewarding only at first, and then to become less rewarding again because of the person's increasing speed at achieving the criteria for self-reward. As long as games of tic-tac-toe dole out wins and losses in a pattern that repays the cost of paying attention to the game, a child will value them. When the range of possible outcomes is so familiar that he anticipates them all at the outset of the game, it ceases to be a useful rationing device for self-reward and is no longer valued. To go on with this method of disciplining reward, the child must take up draughts or checkers, and perhaps chess in turn. Similarly, when a daydream or a joke becomes familiar the mind leaps ahead to the ending, dissipating the suspense and poorly repaying the cost of paying attention to it in the first place. The person must search for new daydreams or new jokes, or undertake an activity even less under his control, such as a challenging relationship with another person. To remain useful as a rationing device, the activity must either: (1) change so that it remains novel (golf on new courses, new foods, new sexual partners, new tunes and, as the style in which the tunes are produced becomes increasingly familiar, new styles of tune) or (2) be intricate enough to defy total comprehension – this is the quality a work of art must have to save it from the obsolescence of fashion (Empson 1930).

Thus problem 3, with susceptibility of some but not all rewards to changes of fashion, can be brought within a consistent behavioural framework.

Rewards that are essentially by-products

The fourth problem, why many significant rewards cannot be sought directly, can be discussed within the same framework. The direct production of a reward implies control, and increasingly masterful exercise of the person's control is apt to attenuate the reward through premature satiation. If a person could make himself laugh, or make himself content, he would probably keep himself satiated in these modalities. In doing so he would make them trivial as sources of

reward, unless he found it practical to bind their consumption to rationing devices: flexing one's leg is a powerful reward to someone who has been tied up or splinted, but it is insignificant to people who can move freely, because direct action harvests the potential pleasure as soon as the least bit has built up. However, building up appetite in this modality is not worth the effort, or we would see examples of physical confinement used as a rationing device, in the same way that saunas seem to build up potential reward by depriving people of comfortable temperatures.

It may be that a 'by-product' reward is noticed as a reward precisely because there is some natural impediment to obtaining it by direct action. It may still motivate behaviour to obtain it, of course; but insofar as ostensible 'tries' to obtain it are counter-productive, they may pose the same problem as other temporary preferences pose to other long-term interests. To obtain the by-product reward, the person may have to precommit himself not to try to seize it directly. He may even have to be unaware that the behaviour he finally adopts is a means to get that reward (the precommitting device of attention control, discussed above). Thus, while a person will probably not undermine his wish to laugh if he buys a joke book, he may find no conscious strategy that brings contentment. The only way to defeat his tendency to make selfish grabs at it may be to tell himself that virtue is its own reward, keeping in the distant back of his mind the idea that virtue may also be rewarded by contentment. This situation is not an exception to the usual laws of operant reward – only a ticklish impulse control problem.

The irrational valuation of money

The literal function of money is to induce other people to give us goods or services. Insofar as it functions reliably, it poses the same opportunities and dangers as the available goods and services do. In people's spontaneous perceptions, it should be highly valued when something that can be bought is both intensely rewarding and imminently available, and less valued at other times. Unless a person takes steps to stabilize this value, he will earn and spend impulsively, behaviours that will not only fail to serve his own long-term interest, but make him a poor competitor with respect to other earners and shoppers. He should

thus be motivated to adopt precommitting devices to control his future behaviour towards money, the most powerful of which will be private rules.

Financial behaviour is especially suited to control by private rules, since it is by its nature concrete and quantifiable. For most people in Western society, money ceases to be a simple means to immediate ends, valued when we need it for a specific purchase but not otherwise. Instead it is assigned value according to an extensive set of private rules designed to maximize objective income despite fluctuations in one's spontaneous preference. Various private rules require a person not to live on capital, not to go into debt or to go into debt only under specific conditions, to live within a budget, to discount future income only at the bank rate, to buy large items only when they are on sale, etc. Where the discipline of financial planning would undermine other valued activities, the person defines exceptions: money is not to be weighed against affairs of the heart, or counted as a reason to obey or disobey the law or considered when seeking medical care.

Private rules will dampen swings in the person's valuation of money but, as with other behaviours, they will also introduce a characteristic artificiality into the choice-making process (see Ainslie 1982). Their failure to make financial behaviour simply objective can be seen in occasional examples where a chance for a tiny gain is valued beyond what would be expected, apparently because it serves a precedent. Some people will not allow themselves to pass a penny in the street without picking it up, or to put more postage than necessary on a letter to avoid searching for the right stamps, to be short-changed in any amount by a shopkeeper or vending machine, or to get petrol at a convenient station when an out-of-the-way station is one or two pence cheaper. These are not spontaneous behaviours, but are performed because money 'shouldn't be wasted'. A violation of this rule undermines the person's long-term interests with respect to money in general, and thus has much greater importance than would the loss of the single economic opportunity which was literally at stake. If the person perceives himself to have wasted money, this perception in itself might actually increase his future tendency to waste money in more significant ways. Of course, the person who is afraid of his impulses or unwise in his choice of rules may carry this concern to an inefficient extreme and become a miser, in the same way that anorec-

tics starve themselves to death for fear of seeing themselves give in to their hunger.

Where a long-term interest has created rules, we should see short-term interests negotiating loopholes on the basis of 'just this once', and the rules establishing the value of money are no exception. Entrepreneurs of lotteries seem to find that they can further appeal to people's short-term interests by offering specific, extravagant prizes like sports cars and vacations rather than money, which the person might feel he had to spend sensibly; designating the prize in this way seems to be enough to create the desired exception, even though the person could sell the item or take cash instead under the rules of the contest. It is also well known that tourists on their vacations will buy things they would not ordinarily buy.

Vendors may find they can profit by allying themselves with a customer's short-term interests and providing these interests with the bargaining points they need. If a person rewards himself especially for finding bargains, he may become the willing prey of a vendor who sells inferior goods 'marked down'; this person evades his rule for thrift by claiming that he has found a bargain, and thus his short-term interest is perfectly willing to pay the price of getting inferior goods. Similarly, a person may attach different rules of scrutiny to different price categories, which he divides by the natural bright lines, round figures; the vendor who marks his goods with a price ending in $9.95 invites the person's short-term interest to plead a lower price category against the long-term interest's rules for thrift, without really having created the illusion that the merchandise is substantially cheaper.

When a person gets more money than is necessary to satisfy his visceral needs, he must confront another of its properties: it is a natural counter in game-like activities. He may perceive himself to be earning money simply as a means to various ends, but these ends often have to compete for his attention with the activity of earning (or saving) money *per se*. Insofar as the latter activity predominates, money itself becomes valuable as a rationer of self-reward, and the person starts to behave so as to maximize the aggregate reward realized from this rationing effect rather than to maximize his actual income. Naturally, the rules of this activity will still call for him to maximize income (or minimize expense); otherwise the game will not be 'real', but will be only one of any number of arbitrary activities, thus losing much of its

value as a rationing device. However, maximizing income is a very general criterion, and is susceptible to hedging. For instance, a person may congratulate himself on how much money he saves by recycling glass or using food store coupons, even though if he audited the activity strictly it would not pay for his time.

This example of cheating on rules for realistic money-making is trivial, but some are not. Even professional investors are prone to it, and must be cautioned against it in business schools: For instance, a person who has made a bad investment might be obliged by his rules for valuing money to reduce his rate of self-reward; but if he can regard this investment as part of a larger investment which still stands a chance, he can defer this duty or, if he is lucky, evade it altogether. Thus, protecting his sunk cost, although objectively less adaptive, will be in his best short-term interest. There are many times everyone is motivated to 'fool himself', as it is often called; more properly, what he is doing is finding loopholes in his own private rules on the basis of one short-term interest or another.

Another example, mentioned in problem 5: most people's rules for reality testing will not allow them to entertain the belief that they are rich, but if they buy a lottery ticket they may allow themselves to say, 'I have a finite chance to get rich.' They can permit themselves the self-reward attached to this perception even though they squeaked into it with a one-in-a-million chance. Thus a person's short-term interest may find it worthwhile to buy a situation that reduces his objective expectancy of reward.

Finally, neither money-getting itself nor the activities money makes possible are the only efficient ways to ration self-reward. Indeed, there is much hoary wisdom which says that they are relatively poor at this in the long run. Thus some people may value money extensively, and among these some will be better than others at playing a disciplined game that maximizes the aggregate reward realizable from this activity. Some people will not value money much, and will tend to seek only as much as they need for other ends. And some may change from one to the other in the course of their lives.

These examples of a continuing struggle between spending and saving suggest that the value of money is not established simply by a mental substitution of an amount in pounds for the goods to which a person is attracted, but rather by the personal legislation of a discipline

which requires the person to act 'as if' the money had a certain value, legislation which is modified by a variable amount of evasion. This value ceases to be anything like a scalar quantity, and becomes rather the arbiter of an intricate set of internal conflicts. No wonder the person looks irrational to an observer who thinks he is just trying to maximize income.

Pain as temporary preference for inferior reward

There remains the question of how nature can inflict pain on an organism that can control its own reinforcement. Modern operant theory has corrected many of the awkward features of older, two-factor theories of punishment (Herrnstein 1969); it portrays pain as simple non-reward, to which an organism attends because it contains adaptive information. However, pain cannot be just the absence of reward or, in terms of the model just presented, the absence of effective rationing devices for self-reward. The person in pain is not just bored, as he would be in a stimulus deprivation situation, but feels attacked by a process that prevents him from enjoying food, entertainment or whatever other sources of reward may be available. And yet the person must perform a motivated act, the direction of his attention to the pain, in order for it to have its effect. As we have seen, pain can be and sometimes is deliberately shut out of consciousness. How does nature get people to open their gates to pain?

To function as a deterrent, the reward level of the pain would have to be well below the ambient reward level of the person's usual activities. What, then, could induce the person to give up his usual reward level and pay attention to the much less rewarding, painful stimulus? Hypothesizing that attention to pain is an operant which is necessary to maximize reward in the long run does not solve the problem. For one thing, delayed rewards are heavily discounted; it will be hard to convince anyone who has seen emphysema patients smoking in their hospital beds that people can be relied on to accept pain or deprivation in the present to better their situation in the future. Furthermore, if attention to pain is a goal-directed behaviour, people should be able to stop performing it if they know it is useless in the case at hand; yet the patient who has already arranged for his aching tooth to be pulled is not thereby able to ignore the pain, nor is he able to

ignore the sore socket when the tooth is gone. Even if these problems could be solved, the effect of simple non-reward following a behaviour should be to select against not only the behaviour but the rehearsal of memories of the behaviour, so that the punished person should find himself doing alternative activities without recalling why. This prediction is not supported by the subjective experience of pain as a vivid, hard-to-forget event. Thus the conventional operant theory of pain is inadequate.

Rescue from this quandary, too, comes from the highly bowed discount curves of delayed reward. We have already seen that an immediate but brief reward can temporarily dominate a much more substantial reward that is delayed. This has been found in experiments using a wide variety of time intervals, anywhere from seconds to years. In real-life activities, the conflicts between poorer–earlier and better–later rewards also seem to occur with a wide variety of time bases. The length of time that the smaller reward is dominant will obviously have a great effect on the way the choice is experienced, as will the length of the refractory period between when a reward is consumed and when the choice is again available. Choices that recur in seconds will demand very different responses from choices that do not recur for years. It is apt to take several cycles of preference reversal before the person identifies a short-term interest as a threat to his long-term interest and begins being moved by the latter interest to counteract it. An inferior behaviour pattern that was well rewarded for years before exerting its inhibiting effect on a greater source of reward might never be discovered, or might be discovered only late in the person's life, having been seen up until then as an unmixed blessing. An inferior behaviour for which the reward was dominant for only a split second might never be perceived as rewarded at all; and yet if the split second of dominance was enough to control a behaviour it might seriously lower the person's average level of reward. This last possibility will prove a way to understand pain as part of the temporary preference problem we have been discussing.

Some familiar motivational patterns are classified in the table, according to the probable periodicity of the preference involved. Actual cycle durations probably form a continuum, more or less smooth as particular evolutionary factors have dictated; but it will be illustrative to describe five ranges of this duration, defined by how the

Table 1. *Zones of temporary preference duration*

Descriptor	Distinguishing feature	Duration of cycle	Time until recognized as a problem	Examples
1. Optimal	Never aversive	Life or no cycle	Never	'To love and to work', non-conflictual pleasure
2. Sell-outs	Ambiguous feeling of aversion	Months to years	Decades	7 deadly sins
3. Addictions	Clear periods of pleasure and aversion	Hours to days	Years	Substance abuse, gambling, perversions, kleptomania
4. Itches	Ambiguous pleasurable phase, but person is conscious of participating	Seconds	Minutes	Physical itches, mannerisms, satiated self-reward, compulsions
5. Pains	Never pleasurable, no participation	Fractions of second	Fractions of second	Physical pain, phobias

person tends to report the positive and aversive phases. In the highest range are activities which never undermine more productive ones, even when viewed over the perspective of a lifetime. These activities vary from the ordinary, like eating and sleeping, to the most profoundly meaningful experiences.

In a lower range are activities which people usually find limiting to their life enjoyment, but only after many years. These tend to be the concrete, highly involving, single-goal activities that religious and philosophical books warn us about; they are usually not considered psychopathological unless they lead to life crises, and many people never identify them as a cause of lost reward.

Beneath them are the addictions, in which a phase of clear, conscious preference for the addictive activity alternates with the phase of conscious avoidance of it. Note that this is a psychological definition of addiction, not a physiological one; for instance, not all people who become physiologically dependent on alcohol are ambivalent about drinking. Rewarding substances like alcohol, tobacco or drugs are often the bases of addictive cycles, but so are substance-unrelated activities such as gambling, compulsive sexual activities (exhibitionism, paedophilia, fetishism), and other compulsive behaviours like kleptomania and spree-buying.

In a still lower range, rewarding and unrewarding phases alternate rapidly, leading to rapidly repeated behaviours that generate what is experienced as insubstantial pleasure. The addiction to cigarettes verges on being in this range. Clear members of the range are annoying activities that are hard to give up: itches, behavioural tics, nail-biting and other mannerisms, playing with a sore, etc. A major category are activities that have fallen prey to premature satiation: the desultory rehearsal of worn-out fantasies, listening to stale jokes, or being at an over-familiar movie and feeling intermittent temptation to pay attention. Often the person is not conscious of a pleasurable phase, but he has some sense of participation in paying attention to the relevant cues. Pathological self-consciousness, obsessional doubts or worries and compulsive rituals belong here.

In the lowest range, a rewarding phase is never evident; it can only be inferred from the fact that people repeatedly direct their attention towards the painful stimuli. Presumably the act of attention is sufficient to produce both the reward that motivates it and the inter-

ference with other rewards which soon follows. Repeated rapidly, perhaps too rapidly for the person to distinguish the separate components, this cycle of brief reward and longer inhibition of reward forms a continuing activity that is both unrewarding and hard to resist. This is an adequate operant mechanism for pain. Such a mechanism would explain pain's property of rewarding attention but punishing behaviour (Ainslie 1975, pp. 489–92; and forthcoming).

Phobias may also be in this range, although it might be argued that phobic patients' participation in attending to the relevant cues is no less than that of the obsessive-compulsives I have put in the 'itch' category. Too much should not be made of exact categorization. Insofar as the major mental illnesses have a voluntary component, it is also apt to be in the itch or pain range; for instance, schizophrenics often report that they can 'set up' hallucinations or other forms of regression, and do so repeatedly even though they perceive themselves as suffering from them in the long run.

These examples illustrate how pain can be included in a consistent picoeconomic approach – not the simple negative it has been since before Bentham, but not an exception to the rules of the marketplace.

The results of intra-psychic bargaining

Given the many possible turns of the intra-psychic bargaining process, what will an individual value? In general, he will try to obtain situations which permit a stable compromise between his long- and short-term interests. He will especially seek rationing devices that restrict his self-rewarding activity, but which are not so stringent or rigid that they either reduce his long-term reinforcement rate or make possible a successful rebellion by his short-term interests. For instance, a good game does not let a player win too often, but is not too frustrating, either. To take a more important example: in a robust personal relationship people give each other adequate occasions for self-reward without becoming predictable. The amount of actual supportiveness does not matter, since each person can adjust his own rules for self-reward to accommodate another's scanty approval or even sheer enmity. The unpredictability is what is needed; evasion of this requirement in the interest of short-term comfort leads to stereotyped, mechanical social roles like nurse and dependant, nag

and Rip Van Winkle, etc., which reduces the amount of surprise produced by the relationship and hence its value to the participants.

Surprise is at the heart of the matter. If one word can express the antidote for premature satiation, 'that which cannot be generated by the self but must be obtained from outside', it is surprise. Surprise, not gold, or land or labour, should be the epigrammatic font of value.

If there is no rationing process so challenging that it can overcome the temporary dominance of an available short-term reward, then the person will value anything that directly removes or restricts the opportunity for this short-term reward. For instance, it is usually not practical to engage in activities that motivate ignoring physical pain for long periods of time, and so people buy analgesic drugs to reduce the lure of the painful stimulus itself. Similarly, an alcoholic may obtain disulfiram (Antabuse), and the person who cannot save money may accept the poor interest rates of a Christmas club to make himself do it.

Finally, if the person has not found some way to forestall the attractiveness of a short-term reward, he will ultimately seek this reward. However, as the table indicates, the short-term nature of an interest is apt to be relative. What looks to an observer like a person's capitulation to his short-term interest may in fact be a realistic attempt to forestall a still shorter-term one. For instance, it is not uncommon for people to cultivate a rigid, narrowly self-righteous personal style (Level 2) in order to avoid becoming alcoholic or to overcome alcoholism (Level 3). Similarly, it is said in the psychiatric lore that marginally psychotic people often become alcoholic (Level 3) to avoid regressing into psychosis (? Level 4 or 5). A person may sometimes not aspire higher for fear of sinking lower.

Furthermore, the shape of a hyperbola will permit the interaction of more than two levels (Fig. 5). A high-level interest may ally with a low-level interest to undermine one in the mid-range. For instance, if a person values altruism (Level 1) but is usually too avaricious (Level 2) to give money to charity, he may arrange to gamble (Level 3) in such a way that his expected outcome is to lose money to a 'good cause'. Hence, perhaps, the enduring success of church bingo games and lotteries for charity. Similarly, if a person has good reason to tell someone off (Level 1) but has rigid rules against aggression (Level 2), he may allow himself to get drunk (Level 3) in order to create a situation where he does not feel responsible for his aggressive

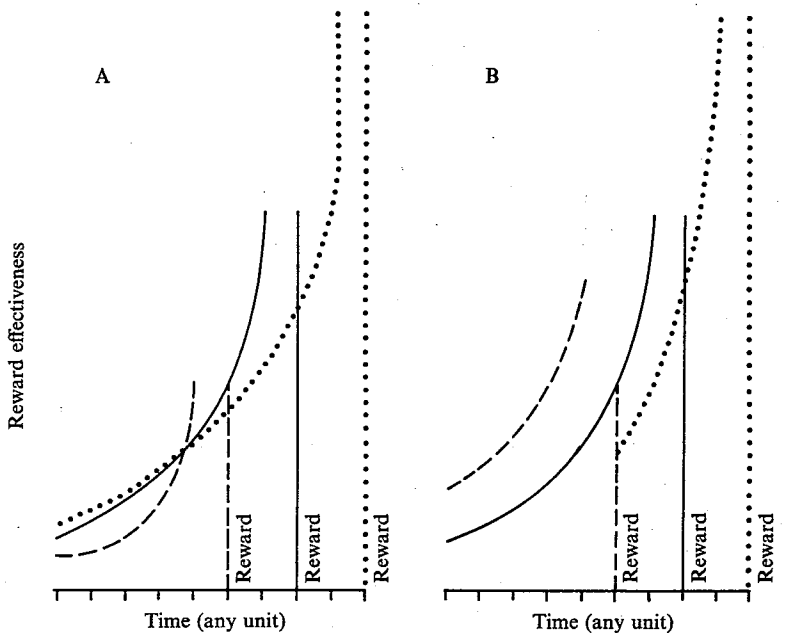


Fig. 5. Hyperbolic curves of the effectiveness of three rewards: A, if each reward is an exclusive alternative to each other reward; and B, if the earliest reward precludes the middle one and the middle one precludes the last one, but the earliest one does not preclude the last one. The summed effect of the earliest and last rewards is depicted by the dashed curve. Note that the curve from the middle reward dominates that from each other reward at some time before the first reward is available in contingency A, but in contingency B never rises above the summed curve from the first and last rewards during the time before the first reward is available.

behaviour. Longer-term interests may 'use' short-term ones in the same way that kings of olden time are said to have allied with commoners to restrict the power of the noble class. The interaction of motivational interests within the individual, although simple in principle, may become as complex as any power struggle between individuals.

Can individual cases be studied empirically?

This chapter has described some of the logical consequences of the highly bowed discount curve described by experimental psychology. The predicted patterns are identifiable in many familiar life situations. In some additional areas where they are not directly observable, they

can be inferred as mechanisms for seemingly irrational choices, since they reconcile these choices with a strictly economic view of human behaviour. Given these highly bowed curves, all behaviour can be interpreted as dependent on operant reward. A corollary of this interpretation is that the laws of bargaining which determine the value of goods in commerce can be extended to deal with the conflict of interests within individuals.

It remains to be seen whether these principles, however internally consistent they may be, will be of practical value in understanding individual people with motivational conflicts.

Certainly the collection of data will be harder than it is with commercial activities. Unlike cash transactions, bargains struck in the mind are not a matter of record. Sometimes an interest will require a transaction to be unavailable to memory. For instance, a short-term interest may be able to prevail by disguising the fact that a particular transaction violates a private rule. Whether or not this occurs in the way Freud described (see Ainslie 1982), it renders the subject unable to report the transaction to the observer.

However, much information may appear unavailable not because people are motivated to be unaware of it, but because they are not in the habit of noticing it. We learn internal bargaining intuitively, by trial and error, in much the way we learn language. The study of this process may parallel linguistics, which has not collected new kinds of data so much as examined ordinary speech in a systematic way. For centuries people spoke well without knowing what nouns, verbs and adjectives were, much less tacts and mands; but these concepts are not hard to teach, even to children, who can subsequently describe their speech quite accurately in such terms. In many cases, the task of understanding an individual's internal interests may be a matter of asking the right questions.

Simple tests can determine whether a behaviour pattern is part of a motivational conflict. For instance:

(1) When temporary preferences persist, that is, when they are incompletely controlled or are controlled only by extrapsychic devices, they are easily identified by the fact that the person foresees them with apprehension and looks back on them with regret.

(2) Private rules can be distinguished from 'rules of thumb' or simple habits by the presence of motivational pressure which is not

accounted for by the outcomes of the choice literally being made, or by the fear of loss of control if a choice is not made in the prescribed direction. Trying an unaccustomed behaviour has little consequence for a simple habit; but if it is a habit of will, the kind of habit with 'force', then, as one Victorian psychologist said, 'It is necessary above all things never to lose a battle. Every gain on the wrong side undoes the effect of many conquests on the right' (Bain 1886).

(3) A criterion for conduct may be understood as a bright line if the subject expresses the idea that change would make the relevant rule meaningless or harder to obey, or if the possibility of changing it raises a feeling of guilt or a fear of loss of control.

Structured interviews to elicit this information about patients' most important behaviours are now being developed.

It may be possible to go beyond subjects' self-reports in getting information about their internal bargaining processes. Subjects' actual behaviour in tests resembling story-telling video games may reveal their tendency to respond in similar situations in real life. The ability of computers to simulate part of a conflictual situation, and to record a subject's response to the computer-generated situation, is just beginning to be explored (e.g. Ainslie and Haendel 1982, pp. 136–8). Motivational patterns elicited in human subjects by such means can then become the basis for fully articulated computer models like those that have been useful in other branches of economics.

However, it is not yet clear whether data gathered in these ways can become the basis of a practical scientific discipline. This approach may be defeated by uncooperative or deceptive subjects. There may also be a psychological analogue of Heisenberg's uncertainty principle which leads a subject to treat all testing situations as special cases, thus rendering important private rules inapplicable. The outcome of these possibilities will determine whether the analysis of bargaining among parts of a multiple self will be a method of gathering useful information about individuals, or just a conceptual boundary for microeconomics.

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