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A Visceral Account of Addiction

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In the past, addiction has been viewed as a *sui generis* phenomenon (Baker 1988). Recent theories of addiction, however, draw implicit or explicit parallels between addiction and a wide range of other behavioral phenomena. The "disease theory," for example, highlights similarities between addiction and infectious disease (e.g., Frawley [1988], Vaillant [1983]). Becker and Murphy's rational-choice model of addiction draws a parallel between drug addictions and "endogenous taste" phenomena, such as listening to classical music to attempt to acquire a taste for it, in which current consumption affects the utility of future consumption (Becker and Murphy 1988). Herrnstein and Prelec's "garden path" theory sees addiction as analogous to bad habits, such as workaholism or compulsive lying, that can be acquired gradually due to a failure to notice a deterioration in one's conduct or situation (Herrnstein and Prelec 1992).

In this chapter, I propose an alternative theoretical perspective that views addiction as one, albeit extreme, example of a wide range of behaviors that are influenced or controlled by "visceral factors" (Loewenstein 1996). Visceral factors include drive states such as hunger, thirst, and sexual desire, moods and emotions, physical pain, and, most importantly for addiction, craving for a drug. All visceral factors, including drug craving, are associated with regulatory mechanisms that are essential for survival, but all are also associated with behavior disorders (e.g., sleepiness and narcolepsy, hunger and overeating, fear and phobias, sexual desire and sexual compulsions, anger and spousal abuse, craving and addiction). At intermediate levels, most visceral factors, including drug craving, produce similar patterns of impulsivity, remorse, and self-binding. At high levels, drug craving and other visceral factors overwhelm decision making altogether, superseding volitional control of behavior.

The defining characteristics of visceral factors are, first, a direct hedonic impact (which is usually negative) and, second, an effect on the relative desirability of different goods and actions. The largely aversive experience of hunger, for example, increases the desirability of eating and also affects the desirability of other activities such as sex. Likewise, fear and pain are both aversive, and both increase the desirability of escape.

The visceral factor perspective (as outlined by Loewenstein [1996]) has two central premises that are especially relevant to addiction: First, immediately experienced visceral factors have a disproportionate effect on behavior and tend to "crowd out" virtually all goals other than that of mitigating the visceral factor. Second, people underestimate the impact on their own behavior of visceral factors they will experience in the future.

The disproportionate influence of immediately experienced visceral factors is relevant to understanding the force and persistence of addictive behavior. It helps to explain why, once addicted, people have such a difficult time quitting, despite the by-then typically obvious benefits of abstinence. Like extreme hunger, thirst, pain, anger, sleepiness, and a wide range of other visceral sensations, drug craving limits the scope for volitional control of behavior. Once the addict is "hooked," and subject to intermittent craving, the scope for volition narrows to the point where it may not be useful, either theoretically or practically, to view the addict's behavior as a matter of choice.

The underappreciation of the force of delayed visceral factors is critical to understanding why people get addicted in the first place. Underestimating the force of the craving they will experience if they try to stop taking the drug, people overestimate their own future ability to stop taking the drug. Early drug-taking behavior, therefore, results from a decision that is distorted by biased expectations.

The visceral account of addiction can be viewed as a hybrid of decision-based and disease perspectives. In the early stages of addiction, drug taking is seen as the product of largely volitional decision making. As an individual becomes addicted to a drug, however, there is a progressive loss of volitional control over drug taking.

The visceral account of early drug taking is somewhat akin to Herrnstein and Prelec's (1992) model of addiction. Both view the addict-to-be as engaged in active, but biased, decision making. The models differ, however, in their views about the source of the bias. In Herrnstein and Prelec's model, the bias results from a failure to notice the incremental detrimental effect of engaging in the addictive activity. In the visceral account, it results from a failure to appreciate the motivational force of future craving.

In its view of the later stages of addiction, the visceral account of addiction bears a closer relationship to the disease perspective. Once addicted, an individual may recognize that abstinence is the best course of action, but his ability to abstain is powerfully constrained by the force of intermittent craving.

The feature of the visceral account of addiction that most starkly separates it from other theoretical accounts is the central role played by cue-conditioned craving. Cue-conditioned craving refers to the tendency for cues that become mentally associated with an addictive drug

to elicit craving for the drug. Although there is a large empirical literature on craving and its role in addiction, the insights from this literature have yet to be summarized in the form of a more general model of addiction.¹ One other theoretical account of addiction – the opponent process perspective (Solomon and Corbit 1974, Koob, Stinus, Le Moal, and Bloom 1989) – does feature conditioning and craving in a prominent role. The opponent process account of addiction, however, focuses on craving associated with withdrawal rather than cue-conditioned craving as the key feature of addiction. The visceral account's emphasis on cue-conditioned craving rather than withdrawal reflects a widespread belief among addiction researchers that craving rather than withdrawal is the critical impediment to recovery from addiction. Just as it is easier to shed weight than to keep it off (NIH Technology Assessment Conference Panel 1993), it is easier to withdraw from most drugs than it is to abstain in the long run (Goldstein 1994; Shiffman 1982, p. 72).

The remainder of the chapter, is organized as follows: Section 1 presents the basic elements of the visceral-factor perspective and discusses in detail the two regularities mentioned above: the excessive influence of immediate, and the insufficient appreciation of delayed, visceral factors. Section 2 demonstrates that drug craving exhibits the same characteristics as other visceral factors and reviews the literature on the determinants and effects of craving. Section 3 presents the rudiments of a theoretical account of addiction that incorporates cue-conditioned craving and draws out implications for who gets addicted, the effects of addiction on behavior, quitting and self-binding, relapse, treatment, and the definition of addiction.

1. The Visceral-Factor Perspective

Technically one can view visceral factors as short-term fluctuations in tastes. However, doing so obscures several crucial differences between visceral factors and tastes. First, visceral factors affect utility directly, even if actual consumption is held constant, and thus they resemble consumption, not tastes. The welfare effect of a change in tastes is a largely philosophical issue, but hunger, thirst, pain, etc. have straightforward effects on well-being, holding actual consumption constant.

Second, visceral factors are correlated with external circumstances (stimulation, deprivation, and such) and, as a result, they tend to fluctuate, often dramatically, over time.² Indeed the abruptness of such fluctuations may contribute to their potency. Changes in tastes, in contrast, are caused by slow experience and reflection, are typically not anticipated, and do imply a long-term change in behavior. Though tastes change, they tend to be stable in the short run.

Finally, tastes and visceral factors probably draw on different neurophysiological mechanisms. Tastes consist of information stored in memory

about the utility conferred by different forms of consumption. Visceral factors, in contrast, result from neurochemical changes in the reward and motivation centers of the brain. "The core of the brain," Pribram (1984, p. 2) writes, "uses chemical regulations to control body functions. The configuration of concentrations of these chemicals, although fluctuating around some set point, is sufficiently stable over periods of time to constitute steady 'states.' These states apparently are experienced as hunger, thirst, sleepiness, elation, depression, effort, comfort, and so on." Their common neurochemical origins may explain why so many disorders that are associated with visceral factors (e.g., overeating, compulsive shopping, phobias, and, perhaps, some drug addictions) appear to be susceptible to moderation by a single drug—Fluoxetine (Messiha 1993).

The Effect of Immediate Visceral Factors

Visceral factors play an important role in the regulation of behavior. They serve as "interrupts" that focus attention on specific high-priority goals. Hunger, for example, signals a current or anticipated nutritional deficit (Toates 1979). Pain (Fields 1987) and fear (Janis 1967) signal the presence of an environmental threat. Virtually all visceral factors, including drug craving, focus attention in such a fashion.

Visceral factors also motivate the individual to achieve the goals on which they focus attention. In most cases, this motivation is experienced as an aversive sensation that can be mitigated by addressing the need signaled by the visceral factor. Thus, hunger, thirst, pain, fear, and drug craving provide motivation for, respectively, eating, drinking, avoidance, flight, and drug consumption. Most visceral factors are aversive, probably because aversion provides a more reliable motivational mechanism than reward. As Damasio (1994, p. 264) argues, "suffering puts us on notice. Suffering offers us the best protection for survival, since it increases the probability that individuals will heed pain signals and act to avert their source or correct their consequences."

As the intensity of visceral factors increase, their influence on behavior tends to exhibit a characteristic pattern. At low levels, people seem capable of dealing with visceral factors in a relatively optimal fashion. For example, a person who is mildly frightened by a dog might decide to tolerate the fear and remain in the dog's proximity, or to leave. There is nothing inherently irrational about taking such visceral factors into account since they do affect well-being and generally serve important regulatory functions. It makes perfect sense to eat when hungry, drink when thirsty, and withdraw when experiencing pain or fear; to be convinced of this one only need glimpse the physical condition of people who are congenitally unable to experience pain (Fields 1987, pp. 3-5).

When visceral factors become elevated further, they tend to produce internal conflicts between behavior and perceived self-interest. Thus, as fear toward the dog increases, the individual may begin to experience a tension between how he *wants* to behave and how he thinks that he *should* behave. One can imagine an internal dialogue such as, "Get a hold on yourself. The dog is harmless; it has never bitten anyone. It can sense that you are frightened." Such efforts at "self-command" (Schelling 1984) are characteristic responses to visceral factors in the midrange of intensity.

Finally, at sufficient levels of intensity, visceral factors overwhelm volitional will altogether. Internal exhortations to do the right thing lose all effectiveness and the individual is likely to engage in self-destructive behavior such as flight (a dog can run faster than a person) or immobilization (Janis and Leventhal 1967). Decision making still occurs, in the sense of an *awareness* of the best course of action, but the individual may be unable to act on such awareness.

When visceral factors overwhelm volitional choice, deviations of behavior from perceived self-interest tend to exhibit a characteristic pattern. Not surprisingly, given their attention-focusing function, they tend to narrow an individual's perceptual and motivational focus. Hunger narrows one's focus to food, fear to options for flight, and so on. At sufficient levels of intensity, individuals make highly skewed tradeoffs between goods and activities that alleviate the visceral factor and those that do not. Sex has little appeal to a person who is starving; food has little appeal to a person in the "grip" of terror.³

Visceral factors also produce a second form of attention narrowing—a good-specific collapse to the present of one's time perspective. Thus, a hungry person makes shortsighted tradeoffs between immediate and delayed food, even when expecting tomorrow's hunger to be as intense as today's. This present-orientation, however, applies only to goods that are associated with the visceral factor, and only to tradeoffs between the present and some other point in time. A hungry person would probably make the same choices as a nonhungry person between immediate and delayed money (assuming that food cannot be purchased) or immediate and delayed sex. A hungry person might also make the same choices as a nonhungry person between food tomorrow versus food on the day after tomorrow. Both of these features differentiate the visceral factor perspective from models that explain addiction on the basis of generalized (across goods and activities) individual differences in time preferences.

Yet a third form of attention narrowing involves the self versus others. Intense visceral factors narrow one's focus inwardly and reduce one's concern for other people. People who are hungry, in pain, angry, or craving drugs tend to be selfish. As torturers understand well, sleep deprivation, hunger, thirst, pain, and indeed most visceral factors can cause even the

most strongly willed individuals to betray comrades, friends, and family (Biderman 1960).

Underestimation of Future Visceral Factors

The second important regularity of relevance to addiction is a tendency for people to underappreciate their own susceptibility to visceral influences. Unlike currently experienced visceral factors, which have a disproportionate impact on behavior, delayed visceral factors tend to be ignored or severely underweighted in decision making. Today's pain, hunger, anger, etc. are palpable, but the same sensations anticipated in the future receive little weight.

In a series of recent papers dealing with topics other than addiction, various coauthors and I have demonstrated what we call "cold-to-hot empathy gaps" – the tendency for an individual when cold (i.e., not experiencing an elevated visceral factor) to mispredict his or her own behavior when hot. In one paper (Loewenstein, Nagin, and Paternoster 1997), we showed sexually arousing photographs to one group of male subjects and nonarousing photographs to another; we then asked them to predict their own behavior in the context of a typical date rape scenario. Aroused subjects predicted a much higher likelihood that they would behave in a sexually aggressive manner, as if being aroused made them better able to imagine what they would do when aroused on a date.⁴

In another paper (Loewenstein, Prelec, and Shatto 1996), my coauthors and I show that people underpredict the motivational impact of curiosity on their own behavior.⁵ Subjects are given a sample geography question, randomly chosen from a list of eleven such questions, and then are given the remaining ten questions. All subjects are given a choice between receiving the answers to the ten questions or receiving a candy bar, but half are given the choice before taking the quiz and the other half are given the choice after taking the quiz. A substantially larger fraction opt for the candy bar before taking the quiz, when they are not curious, than after taking the quiz, as if those in the before condition underestimate the force of their own future curiosity.

In a third paper that bears an especially close connection to the phenomenon of addiction, Daniel Adler and I studied people's predictions of how attached they would become to objects they were endowed with (Loewenstein and Adler 1995). Research on the "endowment effect" (Thaler 1980) has shown that people become attached to an object they are endowed with, even if they would not have desired the object particularly had they not been endowed with it.⁶ In one study we informed some subjects that they would be endowed with an object; we then asked them to predict the price at which they would sell the object back to the experimenter once they were endowed. These subjects, and others who

did not make a prediction, were then endowed with the object and given the opportunity to sell it back to the experimenter. Much in the same way that addicts-to-be seem to underestimate their own future attachment to drugs, subjects who were not endowed underpredicted substantially their own postendowment selling prices.

The cold-to-hot empathy gap may result from limitations in our ability to remember visceral states. Imagination and memory draw on similar neural resources and invoke similar cognitive processes. Human memory is well suited to remembering visual images, words, and semantic meaning, but it seems ill-suited to storing information about visceral sensations. Recalling visual images actually activates many of the brain systems that are involved in visual perception (Kosslyn et al. 1993). Thus, it appears that to imagine a visual scene in the mind is, in a very real sense to "see" the scene again in one's mind, albeit in distorted, incomplete, and less vivid form.

Recall of pain, and probably other visceral factors, however, is qualitatively different. As Morley (1993) observes in an insightful paper, we can easily recognize pain, but few can recall pain in the sense of reexperiencing it in imagination or memory. Morley (1993) distinguishes between three possible variants of memory for pain: (1) sensory reexperiencing of the pain; (2) remembering the sensory, intensity, and affective qualities of the pain without reexperiencing it; and (3) remembering the circumstances in which the pain was experienced. Most studies of memory for pain have focused on the second variant and have obtained mixed results. For example, several studies have examined the accuracy of women's memory of the pain of childbirth, most employing a so-called visual analog scale (basically a mark made on a thermometer scale) (e.g., Rofé and Algom [1985]; Norvell, Gaston-Johansson, and Fridh [1987]). These researchers have reached conflicting conclusions, with some finding accurate, some finding overestimation, and some finding underestimation of past pain.

In contrast to these contradictory findings, most studies on pain memory that have examined the issue are in agreement that subjects possess either Morley's second or third variant of pain memory, but not the first – sensory reexperiencing. For example, Morley (1993) himself, in a survey that elicited pain memories, found that 59% of his subjects were able to recall at least some aspect of the pain sensation, 41% reported that they had no recall of the pain sensation at all, and not a single subject reported actually reexperiencing the pain. Strongman and Kemp (1991) found that spontaneous accounts of pain tended to fit Morley's third variant of pain memory – remembering the circumstances in which the pain was experienced: "Overwhelmingly, the descriptions were of 'objective' details of the events rather than of the feelings of the respondents" (p. 195). Fienberg, Loftus, and Tanur (1985, p. 592) concluded their review of the

research on pain up to 1985 by asking, "Is it pain that people recall or is it really the events such as injuries and severe illnesses?"

People certainly do get viscerally upset when remembering or recalling certain types of pains, particularly those that evoke vivid images (e.g., those resulting from bloody wounds or dentist drills; see Scarry [1985] and Loewenstein [1996] for a fuller discussion of this issue). These pains are likely to be exaggerated both in memory and anticipation (see, e.g., Kent 1985). Drug craving, as well as other types of pains and discomforts such as that resulting from cold (Read and Loewenstein [forthcoming]), however, are difficult to imagine and are thus unlikely to evoke a visceral reaction when recalled or anticipated. The failure to vividly recall or anticipate the discomfort of craving can help to explain the postulated underappreciation of future craving.

There is an additional factor that contributes to the underappreciation of future visceral factors: The well-documented tendency for people to overestimate their own abilities. This tendency is evident in the "above average" effect whereby well over half of survey respondents typically rate themselves in the top 50% of drivers (Svenson 1981) and with regard to their ethics (Baumhart 1968), managerial prowess (Larwood and Whittaker 1977), and a variety of other desirable skills. It is also evident in a piggyback study conducted in connection to the famous Milgram shock experiment in which subjects were informed of the methodology and of the high prevalence of shocking behavior and were asked to guess what they personally would have done if they had been subjects. Most subjects in the piggyback study did not think that they themselves would have administered powerful shocks to the confederate, as if they underestimated the effect on their own behavior of being exposed to the authoritative and relentless pressure of an experimenter (Milgram 1965; see also, Wolosin, Sherman, and Cann 1975). It seems plausible that this tendency to overestimate one's own resistance to external influences would also apply to addiction, that is, that people would have an exaggerated conceit about their own ability to resist the force of craving.

2. Craving as a Visceral Factor

There is a widespread, although not unanimous, belief among addiction researchers that craving plays a central role in addiction.⁷ Craving refers to a "strong desire or intense longing" (Kozlowski and Wilkinson 1987, p. 31). Craving "seems to capture the essence of addiction in terms of its irresistible, compulsive, and anticipatory qualities, ... has a strong appetitive quality, and is often used to describe intense appetites such as hunger, thirst, or lust" (Marlatt 1987, p. 42). Craving produces a powerful, often overwhelming, urge to consume a drug. Even cocaine, which at one time seemed to present the anomalous case of an addictive drug

that did not produce withdrawal or craving, has been shown to produce intense craving, both in humans and other animals (Gawin 1991).

Craving is somewhat different in character from other visceral factors. Whereas most other visceral factors are present from birth, craving arises from a process of neuroadaptation to drug taking (Eikelboom and Stewart 1982, Siegel 1979). Nevertheless, like other visceral factors, craving plays an important adaptive function. Craving is the byproduct of a conditioned association mechanism that acts as an early warning and defense system to anticipate and protect the organism against the disequilibrating effect of the drug.

When a pleasure-producing drug is consumed repeatedly, internal defenses or "opponent processes" are activated to neutralize its disequilibrating effect on the organism (Solomon and Corbit 1974, Frawley 1988).⁸ These processes are triggered by "feedback" mechanisms that signal the drug's presence in the body or its effects, but they can also be triggered by "feedforward," that is, conditioned anticipation of drug intake (Siegel, Krank, and Hinson 1988). The adaptive effect of feedforward is illustrated by a study in which rats who had regularly received a dosage of heroin in a specific room, overdosed when the same dosage was administered in a different room, presumably because the cues necessary for feedforward were missing (Siegel et al. 1982). Craving arises when an individual is exposed to drug-related cues that produce an adaptive response but subsequently does not consume the drug. Although the specific subjective feeling may vary from drug to drug, and perhaps between persons, craving is invariably unpleasant and powerfully increases the desire to take the drug.⁹ Note that these two features—the negative hedonic effect and the enhanced desire for the drug—are the defining characteristics of a visceral factor.

Once an individual is addicted to a drug, craving appears to be the main force that keeps him taking it. Even mild craving seems to have a profound effect on behavior, an effect equivalent to that exerted by other visceral factors only at extreme levels of intensity. Indeed, a number of researchers have wondered why even mild states of craving can have such a profound influence on behavior. One explanation, offered by Berridge and Robinson (1995), is that people can crave drugs with little or no conscious awareness of doing so. Another possibility is that craving derives its incentive value not from its intensity, but from its constancy; it simply doesn't go away until the need that it signals is satisfied.

Determinants of Craving

As endogenous taste models assume (e.g., Becker and Murphy [1988], Herrnstein and Prelec [1992], Koob et al. [1989]), craving tends to be positively related to the duration and intensity of prior drug use, and

craving sometimes occurs automatically upon cessation of consumption – a phenomenon referred to as “withdrawal.” However, there is a growing consensus that withdrawal itself does not constitute the major impediment to quitting, in part because highly effective therapeutic interventions exist for withdrawal from many addictive drugs.

Instead, the main impediment to quitting appears to be the problem of craving-induced relapse. As Gawin (1988, p. 12) comments, “during withdrawal, most cocaine abusers can withstand postcocaine anhedonia (withdrawal).” However, “After . . . the [withdrawal] period ends, episodic craving and the risk for relapse remain because of the continued role of conditioned cues.” Relapse is a constant threat because craving can be initiated by almost any environmental cue that becomes associated with the drug – for example, time of day, a particular room or even the color of the room, the presence of specific individuals or paraphernalia associated with drug taking (Siegel et al. 1988), sounds, and even positive or negative mood states (Gawin 1991, p. 1582). As Goldstein describes it,

A typical addict smokes 10 to 50 cigarettes every day. Each one is linked to a particular time, place, and activity . . . For example, sitting down to the first morning cup of coffee is a conditioned cue to take out a cigarette and light it. Every meal ends with a cigarette. Sitting down at a desk to work evokes craving for a cigarette. Stepping into the lobby during intermission means light-up time. Just being near other smokers produces an automatic reaching for a cigarette. (Goldstein 1994, p. 114)

Cue-conditioned craving is similarly important for the more intense and immediately destructive addictions, such as addiction to crack cocaine or heroin. Again Goldstein provides a vivid illustration – the behavior of a heroin addict, Charlie T., who had stabilized on methadone with a regular job, but whose urine test one day showed that he had used heroin:

He . . . had suddenly been overwhelmed by an irresistible craving and had rushed out of his house to find some heroin. His description was fascinating: It was as though he were driven by some external force he was powerless to resist, even though he knew while it was happening that it was a disastrous course of action for him. (Goldstein 1994, p. 220)

After further discussion, Goldstein and Charlie T. identified the cue that had triggered the relapse. Charlie T. had been watching a TV program about an addict:

They showed an addict fixing, putting the needle into his vein, and suddenly I felt sick, just like needing heroin. I got that craving. I broke out in a sweat. I had that old feeling that only a fix would cure me (Goldstein 1994, p. 221)

Theoretical models that view addiction as an endogenous taste phenomenon (e.g., Becker and Murphy [1988], Herrnstein and Prelec [1992], Orphanides and Zervos [1995]) assume that decreasing one's taste for the addictive substance is purely a matter of desisting from consumption. The visceral factor account, in contrast, places much greater importance on cues that are capable of inducing craving. Quitting involves much more than ceasing consumption for a certain interval because craving can occur at any time, even years after drug taking has ceased, if the addict becomes exposed to sufficiently evocative cues (Gawin 1988, 1991). Deconditioning – the gradual diminishment in a cue's propensity to evoke craving – can proceed so slowly that cues may retain their ability to evoke craving even after years of abstinence (Niaura et al. 1988, Shiffman 1982), which may help to explain the relatively low rates of successful long-term abstinence from drugs among drug addicts (Hser, Anglin, and Powers 1993).

Successful quitting is thus likely to require a substantial investment in change of environment and lifestyle because addiction “poisons” persons, places, and things associated with it in the sense of imparting them with the ability to induce craving. As Siegel (1982, p. 335) observes, “users will attempt to avoid all contact with cocaine, cocaine paraphernalia and cocaine users when attempting this self-initiated detoxification. Some users report that it is effective to simply avoid dealers or other social users. Others engage in destruction of paraphernalia, and still others employ physical restraint by taking a vacation or even moving to another house or city.” However, regardless of such efforts, it is impossible to completely eliminate the possibility of an encounter with drug-associated cues. Hence, the AA expression “once an alcoholic, always an alcoholic,” and Gawin's (1988, p. 14) pessimistic view that the third, “extinction” phase of addiction to cocaine “persists indefinitely.”

Narrowing of Attention

Craving routinely produces each of the three forms of attention narrowing that are characteristic of all visceral factors. First, it increases the value of the craved substance relative to all other forms of consumption. Frawley (1988, p. 32) refers to a “process of . . . increasing the behavior that facilitates drug or alcohol use and eliminating behavior that interferes with or does not lead to drug or alcohol use. This leads to a kind of ‘tunnel vision’ on the part of the addict.” This effect is most dramatically evident in the behavior of cocaine addicts, who report that “virtually all thoughts are focused on cocaine during binges; nourishment, sleep, money, loved ones, responsibility, and survival lose all significance” (Gawin 1991, p. 1581). It is also illustrated vividly by experiments with rats that were given access to cocaine and a wide range of alternative forms

of consumption. These animals lose interest in food and other forms of consumption, lose weight, and typically die in a matter of weeks (Pickens and Harris 1968).¹⁰

Second, craving seems to shorten the individual's time horizon, particularly when it comes to the drug itself. Addicts are notoriously shortsighted. This is usually viewed as a character trait, and, indeed, it is often seen as *the* trait that caused them to become addicts in the first place. However, myopia is as much the consequence of as the cause of addiction. Moreover, the visceral factor perspective implies that craving-induced myopia takes a very specific form: It increases the immediate desire for a specific drug but leaves time preferences for other items unchanged and should also not affect time preference for the drug in the future. Consistent with this prediction, Madden, Petry, Badger, and Bickel (1996) found that opioid-dependent individuals' time discount rates for heroin were much higher than those for money. In other words, monetary payments lost their incentive value when delayed at a much slower rate than did doses of heroin.

Third, craving is notorious for eliciting destructive behavior that belies a lack of concern for the well-being of other people. The literature on drug addiction abounds with horrifying examples of the destructive behavior of drug addicts, toward family, friends, and strangers. Subjected to the miseries of craving, severe addicts tend to classify people into two categories: Those who threaten to impede access to the drug and those who can serve as tools for obtaining it.¹¹

Imperfect Anticipation of Craving

There are many possible reasons for taking a drug one is not addicted to: Immediate pleasure, peer pressure, relief of depression, etc. These differ across drugs, situations, and people, and they undoubtedly account for much of the variance in drug-taking behavior across persons and situations. The main reason for *not* taking a drug, besides possible immediate negative consequences such as impaired driving or risk of arrest, is the possibility that one will become addicted (that is, not be able to stop), with all its associated negative consequences. Most people view addiction as a negative state of affairs; indeed, due to selective media attention to dramatic cases, stereotypes about the woes of drug addiction may well be exaggerated.

If people truly believed that they would get addicted to a drug—that they would be unable to stop taking it—addiction would almost certainly be less prevalent than it is. However, as discussed earlier, people underestimate both the aversiveness of delayed visceral factors and their influence on behavior. Lynch and Bonnie (1994), for example, report results from the University of Michigan's *Monitoring the Future* longitudinal study that

suggest that high school students underestimate the likelihood of becoming addicted to cigarette smoking. Respondents were asked whether they expected to be smoking cigarettes in five years. Among respondents who were occasional smokers (less than one cigarette per day), only 15% predicted that they might be smoking in five years, but five years later 43% were in fact smoking.

There is also evidence for both forms of underestimation on the part of addicts and "dry" addicts. In the study just mentioned, for example, among those who smoked at least one pack a day, only 32% expected to still be smoking in five years, but five years later 70% still smoked one pack or more per day. More anecdotally, Seeburger (1993), in his recent book on addiction, comments that the motivation to stay off a drug...

lasts as long as the memory of the undesirable consequences stays strong. But the more successful one is at avoiding an addictive practice on the grounds of such motivation, the less strong does that very memory become. Before long, the memory of the pain that one brought on oneself through the addiction begins to pale in comparison to the anticipation of the satisfaction that would immediately attend relapse into the addiction. Sometimes in AA it is said that the farther away one is from one's last drink, the closer one is to the next one. That is surely true for alcoholics and all other addicts whose only reason to stop "using" is to avoid negative consequences that accompany continuing usage. (p. 152.)

Wiktor Osiatynski, in a similar vein, refers to the alcoholic's tendency to underestimate the power of addiction: "After hitting bottom and achieving sobriety, many alcoholics must get drunk again, often not once but a few times, in order to come to believe and never forget about their powerlessness" (Osiatynski 1992, p. 128).

These latter illustrations of the underestimation of visceral factors are particularly disturbing because the people being discussed have had extensive experience with craving. Experience thus does not seem to be sufficient to imprint a memory for the pain of craving. This observation is consistent with research on memory for pain showing that experiencing a pain repeatedly does not go very far in terms of enhancing one's memory for the pain. For example, none of the research on the accuracy of memory for childbirth pain has revealed a significant difference in accuracy between remembered first and subsequent births (e.g., Christensen-Szalanski [1984], Norvell, Gaston-Johansson, and Fridh [1987]).

3. Implications of the Visceral Account of Addiction

The main features of the visceral account of addiction can be expressed in a series of simple diagrams. These resemble the diagrams often used

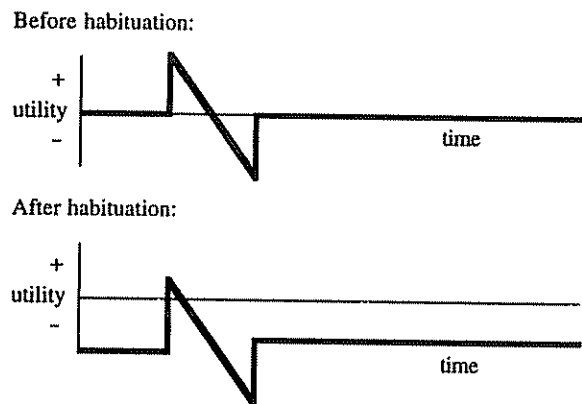


Figure 1. Opponent process account.

to illustrate the opponent process perspective, which are presented first in Figure 1 so as to highlight the difference between the two accounts.

The opponent process account of addiction is as follows: In the early stages of drug taking, the pleasure derived from consuming a drug is gradually neutralized by an opponent process that lingers after the effects of the drug cease, creating a brief period of anhedonia following drug consumption. As drug taking continues, however, the opponent process operates ever-more rapidly, reducing the initial period of pleasure associated with drug taking and intensifying and lengthening the subsequent period of anhedonia. The reduction in the drug's effectiveness due to the increasing efficiency of the opponent process produces tolerance (the need for ever-increasing amounts of the drug to achieve the same effect), and the anhedonia that follows in the wake of drug taking produces withdrawal. The opponent process account of drug addiction, therefore, views *withdrawal* following cessation of drug taking as the mechanism responsible for drug dependence.

As noted earlier, however, it is not withdrawal, but cue-conditioned craving, that appears to be the major impediment to abstinence. As Washton (1988, p. 34) notes in the context of cocaine addiction, "most cocaine addicts find it easy to stop using the drug in the short term but very difficult to avoid using it in the long term." Indeed, the very ease of stopping in the short run may exacerbate the difficulty of stopping in the long run. Washton continues: "After a few weeks or months of abstinence, the patient may have the illusion of being cured. This illusion is often the result of ignorance and/or denial about the chronic nature of addictive disease, ... a tendency to misinterpret one's ability to refrain from drug use as proof that the addiction problem no longer exists" (Washton 1988, p. 35).

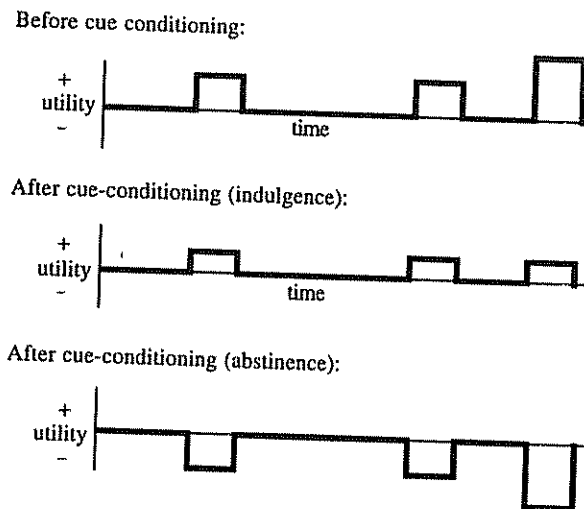


Figure 2. Visceral account.

Cue-conditioned craving is the major aspect of drug addiction that is incorporated in the visceral account of addiction. It does not play a role in most other theoretical (as opposed to empirical) treatments of addiction.

The visceral account of addiction is depicted in Figure 2, the first frame of which depicts the time course of utility of a person who is not yet addicted but who is consuming an addictive substance at three points during some relevant period of time. In the case of cigarettes, the diagram might depict cigarettes consumption during the space of an hour, for coffee or alcohol, glasses consumed during the course of a day (e.g., one at lunch and two in the evening), and for cocaine, binges occurring during the space of a week (with the largest consumption episode occurring on the weekend). It also might be the case that the timing of the episodes are dictated not by clock time, but by other regular or semi-regular events: Meals, routine tasks, or meetings with friends. As the individual continues to consume the addictive substance, either time of consumption itself, or other cues, initiate feedforward mechanisms that neutralize the effect of the drug when it is consumed (second frame of Figure 2) and produce craving when the drug is not consumed in the presence of the cues (third frame). Thus, over time, the pleasure derived from drug taking declines, and the individual experiences ever-worsening levels of craving if he fails to take the drug when in the presence of drug-related cues. Even in this cursory diagrammatic form, the visceral account of addiction provides several testable predictions as well as prescriptions for treatment and policy.

Who Gets Addicted

Each of the major theoretical accounts of drug addiction postulates certain causal mechanisms that lead to addiction and that, in turn, suggest that particular types of people should be vulnerable to addiction. The disease model (e.g., Vaillant [1983]), for example, points to genetic susceptibilities to specific types of addictions or classes of addictions, in the same way that people differ in their genetic susceptibility to different types of diseases. There is substantial research pointing to genetic bases of addiction, although the heritability findings are at present somewhat unsatisfying at a theoretical level. It is highly unlikely that there is an "alcoholism" or "cigarette addiction" gene, so these studies inevitably raise the question of what underlying traits (e.g., impulsivity, the pleasureableness of drug use, susceptibility to peer influence) are, in fact, responsible for the observed genetic associations.

Becker's rational choice perspective focuses on low immediate or anticipated utility as the main state or trait that is predictive of drug addiction. Indeed, in his model the whole point of consuming addictive substances is to relieve low states of utility. However, although it is true that common stereotypes depict addicts as people who were miserable to begin with, the evidence is, in fact, somewhat mixed. McLellan, O'Brien, Metzger, Alterman, Cornish, and Urschel (1992, p. 232) do report that addicts suffer from a wide range of other medical disorders, family and employment problems, and psychiatric conditions, but Gawin (1988) notes that fewer than 50% of those seeking treatment for cocaine exhibit measurable psychiatric disorders, whereas only 10–15% seem to have major affective disorders. The general issue of psychiatric functioning is complicated by the relative dearth of prospective studies and the resultant lack of an obvious comparison group for evaluating the relative severity of observed symptomatology. Even if such a comparison group existed, and the comparison revealed poorer psychological functioning among addicts, however, this would not necessarily support the causal chain implied by Becker's model. It is quite possible that the pathologies observed in addicts are themselves the product of addiction or that they are unrelated causally and are simply features of the types of people who, for other reasons, tend to get addicted. Indeed, as Fischman (1988, p. 7) notes, the notion that "an organism or a person has to have some prerequisite pathology to find cocaine appealing" is challenged by "the fact that species and conditions of availability seem to be irrelevant to cocaine self-administration."

Finally, there is a class of models that view addiction as the consequence of prediction errors. Herrnstein and Prelec's (1992) "garden path" theory of addiction, for example, assumes that people fail to notice, or for

some other reason ignore, the negative effects of consuming the addictive substance on satisfaction from other activities.¹² Herrnstein and Prelec's model identifies two major traits as critical for addiction: An individual's ability to "handle" the drug (in the sense that the drug has a rapid negative effect on the return from alternative activities) and the failure to notice such effects. According to this scheme, the addiction-prone are those who cannot handle the drug but are unaware of this. Becker's model assumes away the latter form of prediction error (unawareness of the drug's effect), and it predicts that the first factor—an individual's ability to "handle" the drug—will be positively rather than negatively related to addiction.

Like the garden-path perspective, the visceral factor perspective sees addiction as resulting, in part, from an imperfect anticipation of future tastes. However, whereas Herrnstein and Prelec attribute the prediction error to a failure to notice gradual change, the visceral factor perspective attributes it to an underappreciation of the force of future craving. Herrnstein and Prelec's perspective provides a useful account of some forms of addiction, specifically those in which the addiction unfolds very slowly as a result of subtle changes in tastes or in the environment, and in which the threat of addiction is not well publicized. Workaholism is such an example; every extra hour one works has an imperceptible negative effect on the quality of one's home life, and the hazards of workaholism are not well publicized. Their model applies less well to drug addictions such as smoking (where the risks are very well publicized) or crack where addiction is quite rapid and the risks are again well publicized.

Like other theoretical perspectives, the visceral factor perspective implies that people with specific character traits will be susceptible to addiction. First, the individual must consume the drug in the first place, either because the drug itself is pleasurable, because it satisfies some underlying need, or as a result of social reinforcement for drug use. Second, repeated use of the drug must, in fact, produce cue-conditioned tolerance and craving. Third, and most unique to the visceral account of addiction, the individual must underestimate the aversiveness and force of craving.¹³ All three of these characteristics might be general traits that are applicable to a wide range of drugs and also to other visceral factors, or they might be specific to particular drugs and only to drug taking. One individual might find drugs generally pleasurable, tend to experience cue-conditioned craving for a number of drugs, and tend to overestimate such resistance across the board; this would correspond to the case of an "addictive personality." Another individual might exhibit these characteristics but only with respect to one or a limited subset of drugs.

The Effects of Addiction

In many theoretical formulations, the negative effects of addiction follow from the assumption that, following repeated consumption, other activities become devalued, both absolutely and relative to consumption of the addictive substance (e.g., Becker and Murphy [1988], Herrnstein and Prelec [1992], Orphanides and Zervos [1995]). Such theories draw connections between addiction and other endogenous taste phenomena such as the enhancement in taste for classical music or haute cuisine following repeated exposure. They fail, however, to shed light on many central characteristics of addiction that are also features of other types of behaviors that are influenced by intense visceral factors.

First, addiction often does not entail continuous, or even highly regular, consumption of a drug. Consumption of many drugs is episodic, and many, if not most, addicts go through periods of abstinence, which are typically interrupted by relapse. For some alcoholics, for example, periodic binges are followed by long periods of little or no drinking. Cigarette smokers are notorious for their frequent, but rarely successful attempts to quit permanently. Even cocaine addicts alternate between binges and abstinence (Gawin 1991). Rational theories of addictions, such as Becker's, and more generally endogenous taste change theories such as Herrnstein and Prelec's, have a difficult time dealing with such episodes. This type of pattern follows naturally, however, from the visceral factor perspective, since craving, which is assumed to be the major force driving addiction, is as transient as any other type of visceral factor.

Second, the visceral factor perspective helps to shed light on why addiction is so commonly associated with inner conflict and attempts to control one's own behavior—both of which are ruled out by models such as Becker and Murphy's. Such conflicts arise because visceral factors affect behavior much more than they affect cognitive deliberations concerning self-interest (see Loewenstein [1996]). Many addicts may recognize, even at the moment of succumbing to their addiction, that they are not acting in their own self-interest. In the view of the visceral factor perspective, their inability to control their behavior is more than just a rationalization. Although other choice-based theories of addiction can explain why addicts wish, *ex-post*, that they were not addicted, these theories typically assume that, given the change that has occurred in their tastes, addicts view the current benefits of consuming the drug as justifying the costs.

Third, an important implication of the visceral factor perspective is that there will be a shortening of the time perspective with respect to the addictive substance (or any substance that is directly affected by the visceral factor), but not with respect to other forms of consumption. Drug addicts should make normal, or even farsighted,¹⁴ tradeoffs between immediate and delayed food, but they will look impatient when it comes to

tradeoffs between immediate and delayed consumption of the drug they are addicted to. Other theoretical accounts of addiction either predict no connection between time preference and addiction or they assume that the causality runs in the other direction (i.e., that addicts become addicted as a result of their generalized impatience).

Finally, the visceral factor perspective predicts extreme fluctuations in the addict's concern for the well-being of other persons, in direct relation to fluctuations in craving. According to the visceral factor perspective, the addict will be extremely self-centered during periods of craving but, when not experiencing craving, should be perfectly normal (or even extra self-sacrificing as a result of guilt). Such a pattern of alternating extreme selfishness and remorse is, of course, characteristic of alcoholics and other drug addicts.

Quitting and Self-Binding

The underestimation of delayed visceral factors can help to explain the prevalence of self-binding behavior among addicts. The alcoholic who takes Antabuse (assuring him or herself of horrible withdrawal symptoms), the smoker who ventures off into the wilderness without cigarettes (after a final smoke at the departure point), and the dieter who signs up for a miserable, hungry vacation at a "fat farm" are all imposing extreme future misery on themselves at a point in time much more imminent than when the benefits of abstinence will be enjoyed. To those who view these behavior disorders as manifestations of myopic time preferences, such seemingly farsighted behavior must seem anomalous. Perhaps, however, the readiness to impose imminent pain on oneself does not result from farsighted preferences but from the failure to appreciate the reality of the near-future pain associated with abstinence in the face of craving. Such a tendency to underestimate craving is, according to the visceral account of addiction, exactly what causes people to become addicted in the first place.

Self-binding, however, requires a special combination of prediction errors. To bind oneself in the first place requires some appreciation for the influence of future craving on one's own behavior. Individuals who fail to recognize their own powerlessness in the face of craving will see no need to self-bind. At the same time, however, as noted in the previous paragraph, self-binding requires a lack of appreciation of the pain that one will experience as a result of being unable to mitigate the craving. This latter condition for self-binding probably explains why addicts rarely self-bind in moments when they are experiencing active craving. Self-binding requires an intellectual appreciation of one's powerlessness in the future combined with a relatively cavalier attitude toward future misery.

Relapse

Relapse is a natural consequence of the visceral factor perspective, due to the postulated inadequate appreciation of future visceral states. Relapse results from misinformed decisions taken with an underappreciation of the impact of future craving.

The ex-addict may underestimate the risks of taking even a small quantity of the drug. There is substantial evidence that small quantities of drugs act as powerful cues that reinitiate craving for a drug that one was addicted to in the past (Gardner and Lowinson 1993). Subscribing to the myth of controlled alcohol, smoking, or drug use, the individual may find himself resuming previous consumption patterns with startling rapidity (Stewart and Wise 1992).

Furthermore, the addict is likely to underinvest in craving reduction for at least two reasons. First, if people underestimate the power of craving, as seems to be the case, they will also tend to underestimate the benefits of treatment. Second, if they underestimate the ability of environmental cues to elicit craving, they will underinvest in changing their environment. Craving reduction is an expensive proposition since it is likely to require changes in location, friendships, consumption habits, and other cues associated with drug taking, and addicts are unlikely to make such investments if they fail to understand their value. As O'Brien et al. (1988, p. 18) write, addicts "often... return home after a period of brief treatment feeling well and confident that they will not resume drug use. They are usually surprised to suddenly feel craving, withdrawal, or even 'high' when they encounter people or places associated with their prior drug use." That addicts are caught by surprise by their own craving is not itself particularly surprising; social scientists themselves have only recently begun to appreciate the potency of conditioned craving and its importance for addiction and relapse.

Willpower

The concept of willpower, which played a central role in nineteenth-century accounts of the conflict between passion and reason, has yet to find its place in twentieth-century social science. Despite its prominent role in popular views of addiction, the role of willpower has been dismissed, ignored, or defined in a counterintuitive fashion in recent theoretical accounts of addiction. Disease theorists, for example, tend to view willpower as little more than a code word for the inverse of susceptibility or even to dismiss the role of willpower, as exemplified by O'Brien's comment that "addictive disorders... are mistakenly thought to be under the control of 'willpower.'" Ainslie (1992, and this volume), in contrast,



Figure 3. After cue-conditioning (abstinence).

while not denying the importance of willpower, tends to view it as an astute application of self-control strategies such as bunching and self-binding.

In its common usage, willpower refers to a type of inward exertion, force of concentration, and tolerance of pain or discomfort (see, e.g., Baumeister, Heatherton, and Tice [1994]). Thus, a runner's exertion of willpower reflects the pain she is able to tolerate to maintain a fast pace; likewise, the willpower that a bored seminar participant mobilizes to remain awake involves inward exertion and concentration, possibly supplemented by an overt self-infliction of pain such as biting one's tongue or stabbing one's hand with a pencil. Although cognitive strategies can also be employed, such as attempting to scare oneself into waking up, the act of will is much more closely linked with the visceral than with the cognitive.

Willpower could be introduced into the theoretical framework depicted in Figure 2 by postulating a short-term constraint in willpower, as depicted in Figure 3. The hatched area inside each episode of craving represents willpower. One might postulate that the individual is able to resist, by dint of willpower, a certain total amount (that is, intensity \times duration) of craving. Thus, in the diagram, the individual could avoid taking the drug in the first and second episodes of craving but would find himself deficient in willpower, and presumably relapse, when the third, most extreme, episode occurred.

A more realistic model would permit replenishment of willpower over time, which would permit the individual to resist intermittent craving indefinitely, provided that the replenishment rate exceeded the product of frequency and intensity of experienced craving. Such a model might also permit some degree of forward-looking behavior; individuals who recognized that they would ultimately lack the requisite willpower to remain abstinent might decide there was no point in abstaining and might initiate drug use at the first sign of craving (O'Donoghue and Rabin 1996). Such a pattern of behavior has been observed in studies of dieters who, when told that they will be fed a caloric meal at some point in the future (e.g., an hour hence), tend to lose their resolve and begin eating immediately (Ruderman 1986). Other patterns of behavior are also possible. For example, one could imagine an individual who begins to exert willpower to forestall consumption, satisfies himself that he is capable of

controlling his own behavior, and then proceeds to indulge, content in the belief that he is not addicted.

An additional property of willpower can shed further light on the problem of relapse: Willpower takes time to build up. Salespeople and actors need to "psych themselves up" before thrusting themselves before their customer or audience respectively. Athletes "pump themselves up" before entering the track or stepping out on the playing field. Similarly, addicts need to "gird," or "fortify," themselves to resist the urge for drug taking produced by craving. The time it takes to mobilize will power may help to explain why it is easier to withdraw from drugs in the short run than to resist craving in the long run; withdrawal upon cessation is highly predictable and can be prepared for psychologically and sometimes even pharmacologically. Craving, in contrast, typically takes one by surprise.

Treatment

Given the preliminary state of the theoretical perspective proposed here, it would be premature to propose or advocate specific kinds of treatments for addiction. Instead I mention some existing treatments of demonstrated effectiveness, whose success can be understood in terms of the visceral account of addiction. The visceral account implies that successful treatments for drug addiction should a) alleviate craving so as to promote quitting and b) maintain a vivid memory of the motivational force and misery of craving for those who have quit to prevent relapse.

Many currently available treatments seem to operate by relieving craving. Fluoxetine (Prozac), for example, and other antidepressants, have been shown to be effective against a wide range of other behavior disorders that are associated with visceral factors, and these may have some benefits when it comes to addiction. It would be interesting to assess whether the effectiveness of antidepressants results from their capacity to mitigate craving, as some have suggested (Gawin 1991). Deconditioning craving by repeated exposure to drug-related stimuli also seems to be beneficial (O'Brien et al. 1988). Again, the effectiveness of this treatment, in an area where many treatments fail, reinforces the central role in addiction played by craving.

Treatments that don't seem to work can also be understood in these terms. For example, those that block the pleasurable effects of the drug (e.g., administration of opiate antagonists such as naltrexone) appear to be ineffective, perhaps because few people can tolerate their aversiveness. Likewise, controlled drinking by ex-alcoholics may fail because consumption of small amounts of alcohol intensifies craving for further consumption.

Keeping "alive" memories of the aversiveness and power of craving involves more subtle interventions than does reducing craving, but nevertheless seems to be possible to achieve. One method is to expose addicts who have quit to the agonies of people who are still addicted or who have recently quit and are thus engaged in an acute battle against craving. Alcoholics Anonymous currently serves this function by bringing ex-alcoholics into regular contact with people who have just quit or who are struggling with quitting, and by prescribing daily attendance for a year, followed by regular attendance for the duration of one's life.

A second method would involve exposing addicts to information that helps them to remember their own agonies while addicted. Innovative research by Gold (1993, 1994) on the sexual behavior of gay men suggests that one means of achieving this might be to persuade addicts to keep a daily diary, both while they are actively addicted and during the early, painful, stages of quitting. Much in the same way that poor memory for craving promotes relapse, according to Gold (1993, 1994), unprotected sex occurs in the heat of the moment (under the influence of a visceral factor) but people can't remember or predict what the heat felt like, and so, enter the next sexual encounter unprepared to deal with it. Based on this intuition, Gold (1994) tested an intervention designed to increase condom use. He had gay men recall as vividly as possible the last sexual encounter in which they had engaged in unprotected anal intercourse. He then compared this intervention to a no-intervention control group and to a standard intervention in which subjects were exposed to didactic posters they had not previously seen. The percentage of men in the three groups who subsequently engaged in two or more acts of unprotected anal intercourse differed dramatically between the three groups: 42% and 41% for the control and poster groups, but only 17% for the self-justification group.

What Is an Addiction?

At present the term addiction is used to refer to a multiplicity of behavioral phenomena, to the point where the term is being applied to any compulsion or socially proscribed habit. We speak of "sex addicts," and refer to people as addicted to crossword puzzles and gambling. Should these be considered addictions? My opinion is that conditioned craving should be taken as the defining feature of addiction. In stating that the craving must be conditioned, I side with the endogenous taste theorists: The taste must be acquired in some fashion, a condition that would rule out generic sex as an addictive activity. People are born with a desire to have sex, albeit some more than others, and intense desire often precedes any actual experience. Thus, the term "sex addict" is no more appropriate than would be "food addict." Although it could be argued that some

people are, in fact, food addicts, in my opinion this categorization is an error that results from confusing the general "disorder" with the more specific "addiction." I suppose, however, that one could become addicted to a particular type of food or particular type of sex due to repeated exposure, as one could to crossword puzzles. Significantly, this definition would exclude gambling from the ranks of addictions since, although once they begin they may have difficulty stopping, the best evidence seems to be that gamblers do not experience significant craving when they do not gamble (Rosenthal 1989).

Addiction and Rationality

A critical question, with significant ramifications for social policy, is the rationality of addiction. A determination that addiction does not result from rational decision making would undercut two frequently advocated, though opposite, policies toward drug addiction: Severely sanctioning drug use and completely legalizing it. On the one hand, if addicts' drug use is not a matter of choice, then it makes no sense either practically or morally, to sanction it. On the other hand, if initial decisions to use a drug are systematically biased then legalization has the potential to produce a social catastrophe.

With the exception of Becker's straightforward position on the rationality issue, however, addiction theorists, researchers, and practitioners tend to adopt a somewhat self-contradictory stance. Although most acknowledge the powerful force of addiction on behavior, most also believe that people must be held accountable for their behavior as a matter of policy. The Alcoholics Anonymous literature, for example, exhorts alcoholics to recognize their lack of control over alcohol but at the same time counsels those who come into contact with alcoholics against coddling the alcoholic, thereby undermining his incentive to quit drinking. The belief that incentives influence behavior implicitly assumes that alcoholics do in fact have some control over their drinking behavior. A similarly ambivalent attitude on the rationality issue can be seen in Goldstein's description of relapse. Despite his self-portrayal as a disease theorist, Goldstein believes that drug users should be held personally accountable for their behavior. Consistent with this policy perspective, he describes relapse as the outcome of a decision: "Relapse is always preceded by a *decision* to use, . . ." But the passage then continues ". . . however vague and inchoate that decision may be. It is an impulsive decision, not a rational one; and it is provoked by craving—the intense and overwhelming desire to use the drug" (Goldstein 1994, p. 220; emphasis added). Goldstein's use of adjectives such as "impulsive" and "inchoate" to describe the decision, and his depiction of craving as "intense" and "overwhelming" point to severe limitations in the scope for volition in this "decision."

Like Becker and Murphy's perspective, the visceral factor perspective provides a straightforward answer to the rationality question. It points to important departures from rationality both in the initial decisions that lead to addiction and in the behavior of addicts. The decisions that lead to addiction reflect a systematic bias in our ability to predict our own future feelings and behavior. Once addicted, behavior is periodically driven by craving, which overwhelms rational deliberations concerning self-interest. Moreover, addiction is not alone in possessing these features; addiction is only one, albeit extreme, manifestation of the effect of visceral factors on behavior. Scientists and social scientists, however, often study extreme cases precisely because they reveal the essential features of a phenomenon. Economists focus on the great depression, neurologists on brain lesions, perceptual psychologists on optical illusions, and decision theorists on choice anomalies. The study of addiction may, therefore, shed light not only on addiction itself, but may help to illuminate an assortment of other phenomena that are influenced by visceral factors. Visceral factors are a ubiquitous aspect of everyday life and regularly undermine the rationality of decision making, both due to their underestimation in prospect and their disproportional force when they operate in the present. Whereas Becker and Murphy view addiction as one additional illustration of the universal applicability of the rational choice perspective, I view addiction as one of many types of human behaviors that are *not* usefully viewed as rational.

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NOTES

1. For a more general theoretical model of preference that incorporates the role of cues, however, see Laibson (1994).
2. Although visceral factors themselves tend to fluctuate relatively dramatically, an individual's *proneness* to experiencing different types of visceral factors typically evolves more gradually.
3. In economic parlance, the marginal rate of substitution between goods and activities associated with the visceral factor (e.g., food for hunger) and all other nonassociated goods and activities diminishes.
4. We cannot, of course, rule out the possibility that sexually aroused subjects do not predict their own behavior more accurately but actually overpredict their own likelihood of behaving aggressively.
5. Curiosity is widely viewed as a type of drive or appetite that shares many properties with other drives, such as hunger and, especially, the sex drive (see Loewenstein [1994]).

6. In a typical demonstration of the effect (see, e.g., Kahneman, Knetsch, and Thaler [1990]), one group of subjects (sellers) are endowed with an object and are given the option of trading it for various amounts of cash; another group (choosers) are not given the object but are given a series of choices between getting the object or getting various amounts of cash. Although the objective wealth position of the two groups is identical, as are the choices they face, endowed subjects hold out for significantly more money than those who are not endowed.
7. In the recent past, Wise (e.g., Wise and Bozarth 1987) and others did question the importance of craving (conditioned association) for addiction. As Wise noted, animals can get virtually instantly addicted to cocaine and other substances without prior exposure. Since the animal would not seem to have had a chance to habituate to or become conditioned to the substance so quickly, these elements do not appear to be necessary for addiction. However, subsequent research by Wise and his colleagues (e.g., Gratton and Wise [1994]) shows that cocaine administration results in remarkably quick habituation and conditioned association; animals exhibit physiological signs of distress shortly preceding even the second administration of cocaine, and these distress signs rapidly escalate with subsequent administrations.
8. This is a simplification of reality. Some drugs operate specifically by producing disequilibrium such that the organism responds in a pleasure-enhancing fashion – e.g., by administering its own opiates (Eikelboom and Stewart 1982). In these cases, conditioned cues will produce the opposite of craving.
9. A mild example of feedforward and its effects can be seen in the dramatic increase in hunger often experienced right before dinner, especially when one can smell, see, or hear dinner being prepared. If dinner were to be suddenly postponed or canceled after exposure to such cues, the result would be a very mild form of craving, which would provide a strong motivation for snacking.
10. It is true that cigarette smokers who quit often overeat, and drug addicts are notorious for substituting other drugs when their drug of choice is not available; craving can have spill-over effects to closely related alternative forms of consumption. But, craving favors certain forms of consumption over others. Thus, food for the ex-smoker has a slim appeal relative to that of a cigarette.
11. Wiktor Osiatynski, personal communication.
12. Herrnstein and Prelec dismiss Becker's model as depicting a process of "self-medication" (1992, p. 333), a charge that Becker probably would not deny. Becker would probably dismiss Herrnstein and Prelec's theory on the basis of its assumption of "irrationality."
13. Although such underestimation seems to be characteristic of all visceral factors (Loewenstein 1996), there may be unique contributing factors when it comes to drugs. First, people who freely consume the drug in the early stages of an addiction may forestall craving through consumption, and may, therefore, not actually experience full-blown craving until it has intensified severely. Second, people may have the wrong model of drug addiction. People who are unfamiliar with the concept of cue-conditioning may point to periods of abstinence (e.g., "I never drink before lunch," or "I'm able to go off coffee when I'm on vacation") as evidence that they are not addicted. Their model of addiction is more akin to the opponent process perspective, which

implies relatively constant consumption over time. They infer from the absence of craving or craving-driven consumption during certain time periods that they are in full volitional control of their behavior.

14. The addict may become even more patient with respect to goods that are substitutes for the drug the addict is addicted to, because drug consumption will effectively mitigate the effect of visceral factors that are increasing their immediate value. For example, cocaine addicts may be especially patient with respect to food because cocaine craving crowds out hunger.

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Epilogue: Rationally Coping with Lapses from Rationality

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A man gave up smoking three months ago. For the first six or eight weeks he was regularly tormented by a desire to smoke, but the last three or four weeks have been less uncomfortable and he is becoming optimistic that he has left cigarettes behind for good. One afternoon a friend drops in for a business chat. The business done, our reformed smoker sees his friend to the door; returning to the living room, he finds, on the coffee table, an opened pack of cigarettes. He snatches up the pack and hurries to the door, only to see his friend's car disappear around the corner. As he will see his friend in the morning and can return the cigarettes, he puts the pack in his jacket pocket and hangs the jacket in the closet. He settles in front of the television with a before-dinner drink to watch network news. Twenty minutes into the news, he walks to the closet where his jacket hangs and takes the cigarettes out of the pocket, studies the pack for a minute, and walks into the bathroom, where he empties the cigarettes into the toilet and flushes it. He returns to his drink and his news.

What have we witnessed? I think we can confidently guess that our subject came to anticipate that in the presence of the cigarettes something might occur that he did not want to happen; by disposing of the cigarettes he has made it not happen. Wasting a dollar's worth of his friend's cigarettes was an inexpensive safeguard. He has coped rationally with the risk that he would do something he did not want himself later to do.

I shall look in more detail at what may have been forestalled, but for the time being let us just interpret the man's act as a rational attempt to prevent some nonoptimal behavior that the presence of the cigarettes might motivate. Tentatively, we might suppose that the man would explain his behavior as anticipating some "irrational act" that he strategically precluded by acting while still "rational."

My usual interest is in how people actually exercise strategy and tactics, successfully or unsuccessfully, in constraining their own future behavior. Often the ways people try to constrain their own future behavior are like the ways they would try to constrain someone else's behavior; they appear