

# PART 1

## Understanding the Psychology and Treatment of Addictions



# 1 Addiction: A Comprehensive Approach

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## CHAPTER OUTLINE

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<b>1.1 INTRODUCTION</b>	<b>4</b>	<b>1.5 THE DYNAMICS OF THE SYSTEM</b>	<b>12</b>
<b>1.2 EXISTING THEORIES</b>	<b>5</b>	<b>1.6 CHANGING DISPOSITIONS</b>	<b>14</b>
<b>1.3 THE HUMAN MOTIVATIONAL SYSTEM</b>	<b>8</b>	<b>1.7 TESTING THE THEORY</b>	<b>15</b>
<b>1.4 INTERNAL AND EXTERNAL SOURCES OF INFLUENCE</b>	<b>11</b>	<b>SUGGESTIONS FOR FURTHER READING</b>	<b>16</b>
		<b>REFERENCES</b>	<b>16</b>

## 1.1 INTRODUCTION

'Addiction' is a social construct which can be usefully defined as a chronic condition in which there is a repeated powerful motivation to engage in a rewarding behaviour, acquired as a result of engaging in that behaviour, that has significant potential for unintended harm. From this perspective, a broad conception of motivation is at the heart of addiction and requires any theory of addiction to be based on a comprehensive theory of motivation. This approach understands addiction can be driven by many different factors – physiological, psychological, environmental and social – and that it is not useful to focus on one particular factor to the exclusion of all others. PRIME theory aims to provide a conceptual framework within which the major insights provided by more specific theories of choice, self-control, habits, emotions and drives can be integrated.

PRIME theory describes the motivational system as the set of brain processes that energize and direct our actions. The system can be usefully divided into five interacting but distinct sub-systems: (1) response execution; (2) impulses/inhibition; (3) motives (wants and needs); (4) evaluations (beliefs about what is good or bad); and (5) plans (self-conscious intentions). The response execution system co-ordinates what is happening at any given moment. The proximal influences on this are the impulses and inhibitions to perform particular responses. Motives can influence behaviour only through impulses and inhibitions, evaluations can do so only through motives, and plans must operate on either motives or evaluations. These can also each be influenced by the immediate internal or external environment. Important internal sources of influence include identity, self-control, drives and emotional states.

A core proposition is that all the subsystems compete with one another and we simply act in response to the strongest influence at any given moment. In terms of deliberate action, this means that from one moment to the next *we will always act in pursuit of what we most want or need at that moment*. These motives vary according to the current strength of evaluations and plans, but also in response to the internal and external environment. For example, if an intention or belief is not currently generating a sufficiently strong motive for performing (or inhibiting) a particular action, then the system may produce an apparently contradictory action in response to a strong internal drive or external stimulus. The operation of this dynamic, complex system is inherently unstable – reflecting the variety in patterns of addictive behaviour – and requires constant balancing to avoid heading into maladaptive 'chreods'. The motivational system can be changed over time by a range of processes including habituation, associative learning, imitation and explicit memory.

This chapter provide a brief background to the origins of PRIME theory, before describing in more detail the proposed structure of the motivational system, important internal and external sources of influence, the dynamics of the system, and how motivational dispositions change over time. The chapter will finish by summarizing addiction research that has been inspired and informed by PRIME theory.

## 1.2 EXISTING THEORIES

There is no shortage of theories about addiction. The book *Theory of Addiction* (West & Brown, 2013), in which PRIME theory was first proposed, was originally intended to provide a convenient overview of available theories. During the course of the research for the book, however, it became apparent that theories of addiction tend to focus on one aspect of addiction or rely upon just one level of explanation. In a problem as manifestly complex as addiction, these approaches are unable to provide a sufficiently coherent and nuanced account of the phenomenon. Existing theories span a range of approaches from those that emphasize choice to those that focus on neuropharmacology. We now summarize some important categories of addiction theory and explain in each case why we believe more comprehensive theories are required. For a fuller account, see Chapters 3–7 in West and Brown (2013).

### 1.2.1 Choice Theories

Examples of theories that focus on addiction as the exercise of choice based on desires are Becker's Rational Addiction Theory (Becker & Murphy, 1988) and Skog's Unstable Preference Theory (Skog, 2000; 2003). Others focus on addicts' 'expectancies' (for a review, see Jones, Corbin & Fromme, 2001). Slovic et al. (2002; 2007) have developed a theory of judgement relating feelings to analytical judgements (an 'affect heuristic') and applied this to smoking. There are theories that focus on attentional, or other cognitive, biases (e.g. McCusker, 2001; Mogg, Field & Bradley, 2005; Field & Cox, 2008). A raft of theories argue that the behaviour of addiction can be understood in terms of concepts derived from economic theory, such as temporal discounting (e.g. Bickel, DeGrandpre & Higgins, 1995; Bickel, Miller Kowal, Lindquist & Pitcock, 2007).

A synthesis of these theories describes an individual who chooses in some sense to engage or not engage in the behaviour. The choice involves a cost-benefit analysis: the costs are weighed against the benefits of the behaviour which change over time and the appreciation of which changes over time. The costs and benefits, and indeed aspects of the analysis, may involve mental representations to which one does not have full conscious access. The choice does not need to be rational; it can be influenced by pharmacological and non-pharmacological factors, including one's sense of self and what one wants to be, and possibly by biases in attention to and memory for stimuli related to the addictive behaviour. In this view, the idea that addictive behaviour is driven by a damagingly powerful and repeated motivation is an illusion based on a failure to appreciate that the expressed desire to stop doing something at one time does not reflect the preferences operating at a later time after the attempt at restraint has begun.

An important problem with this view is that it does not accord with the experience of many addicts. At the point where they find themselves about to relapse back to their old ways, they frequently report feeling compulsion that is distinct from simple desire. It is not even that it is a 'strong desire'; it is an urge that is often accompanied by a sincere attempt to resist. Successful restraint does not simply depend upon analysis leading to a decision to refrain; the implementation of the choice requires

self-control and expends mental effort. By focusing on the choice, the approach neglects the paucity of observational and research evidence for the importance of a failure of impulse control in the development and maintenance of addiction.

### **1.2.2 *Compulsion and Self-Control Theories***

The so-called ‘disease model’ of addiction takes the view that addiction involves powerful and overpowering compulsions that are experienced as ‘cravings’ (e.g. Jellinek, 1960; Gelkopf, Levitt & Bleich, 2002). Examples of theories concerning the failure of impulse control include those that focus on either the dysfunction of inhibitory brain circuitry (Lubman, Yucel & Pantelis, 2004; Dalley, Everitt & Robbins, 2011), or the dysfunction of the prefrontal cortex (Goldstein & Volkow, 2011). A cognitive model of craving has also been proposed (Tiffany & Drobes, 1991). A more general view of addiction as a failure of self-regulation has been proposed by Baumeister (Baumeister et al., 1994; Baumeister & Vohs, 2007; Vohs & Baumeister, 2011). Self-regulation extends beyond impulse control, or the adequate functioning of basic associated mechanisms; instead, it recognizes that failure to self-regulate may also involve a lack of reflective strategies, skills and capacity for self-control. Other examples of theories emphasizing the role of self-regulation in addiction are cognitive control theory (Miller & Cohen, 2001), executive dysfunction theory (Hester & Garavan, 2004; Fernández-Serrano, Pérez-García, Perales & Verdejo-García, 2010; Madoz-Gurpide, Blasco-Fontecilla, Baca-García & Ochoa-Mangado, 2011), and self-determination theory (Deci, Eghrari, Patrick & Leone, 1994; Ryan & Deci, 2000; Deci & Ryan, 2012).

By incorporating theorizing about compulsion and self-control into ideas about choice, many important aspects of addiction are explicable. An addict may be someone for whom the desire to engage in an activity is abnormally strong, or the ability to resist the desire is abnormally weak, or some combination of both. Invoking both avoids the philosophical problem of addicts having ‘no choice’, which is implied by relying only on regulatory failure, and can explain a great deal about addiction. However, a model relying on choice (even if it acknowledges failures in self-control can sometimes be undermined), still has anomalies. A reliance on choice means that behaviour is still fundamentally centred on analyses of costs and benefits (however irrational), whereas, in reality, sometimes behaviour is simply not related to such analysis; instead it is habitual or automatic (i.e., the behaviour itself is automatic, not just the processes by which choices form). Another difficulty for choice models is that sometimes the priority given to certain behaviours can be out of all proportion to any apparent analysis, even allowing for certain biases or unstable preferences. The field of behavioural pharmacology can address this weakness.

### **1.2.3 *Theories Focusing on the Neural Basis of Reward and Punishment***

There are theories that focus on addiction as the development of a habit through instrumental learning (O’Brien, Childress, McLellan & Ehrman, 1992), or through both

instrumental and Pavlovian processes (Everitt, Dickinson & Robbins, 2001; Everitt & Robbins, 2005; Everitt et al., 2008). Others, such as the Opponent Process theory, seek to explain the development of pharmacological tolerance and withdrawal symptoms (Solomon & Corbit, 1973; 1974; Solomon, 1980), which may lead to dose escalation and maintenance of drug use to avoid the aversive consequences of abstinence (e.g. Lewis, 1990; Schulteis & Koob, 1996; Koob, Sanna & Bloom, 1998). There are theories that focus on the neural basis of rewards that underpin addiction (e.g. Wise & Bozarth, 1987; Koob & Nestler, 1997; Koob & Le Moal, 2001; Weiss & Koob, 2001; Hyman, Malenka & Nestler, 2006). There are also theories that focus on Pavlovian conditioning in the development of cravings and dependence (e.g. Melchior & Tabakoff, 1984).

Theories focusing on the neural bases of addiction have become more complex over the years. White (1996) has proposed a theory involving multiple learning pathways. A particularly popular theory differentiates the hedonic effects of addictive drugs from their effects on pathways involved in habit learning in the context of cues (Robinson & Berridge, 2003; Berridge & Robinson, 2011). In that theory, it is claimed that tolerance to the hedonic effects of some drugs occurs while the mechanism underpinning the effect of cues on wanting a drug actually sensitizes as a result of drug exposure. Instrumental learning and classical conditioning models have been combined in a theory that differentiates the effects of addictive drugs on different parts of the brain's reward system (e.g. Balfour, 2004). More recently, attempts have been made to integrate how the neural bases of learning in addiction ultimately relate to dysfunction in inhibitory circuits (Koob & Volkow, 2010).

The addition of associative learning and response mechanisms, and their neural bases which can be affected directly by drugs, improves the explanatory power of a model of addiction. The synthesis of models previously described already recognized that an individual often chooses to engage in addictive behaviour as a result of a cost-benefit analysis of the alternatives, which may be influenced by biases and changing preferences. The concepts of compulsion and self-control account for the phenomenon whereby addicts sometimes sincerely choose to refrain from a behaviour but fail to enact their choice. Learning mechanisms help explain that sometimes behaviour results from a habit with little conscious decision-making, and also why certain behaviours come to be valued out of proportion to the benefits they confer, even after controlling for processing biases or preferences changing over time according to emerging needs or drives.

### **1.2.4 Integrated Theories**

There are few theories that have attempted to span many of the areas considered above, but two that are important to mention are Orford's Excessive Appetites theory (Orford, 2001) and Blaszczynski's model of pathological gambling (Blaszczynski & Nower, 2002). These two theories are able to capture the experience of addiction and they do so by recognizing the diversity of patterns, feelings and routes to addiction. This diversity presents a major challenge to theory development. A synthetic theory must account for the big observations but also needs to be more than a listing of influences and factors; it must synthesize and add value with a unifying construct that itself generates new ideas.

### 1.2.5 The Need for a Synthetic Theory

A theory is needed that provides a parsimonious, synthetic and useful description of the nature of addiction that explains the major observations relating to the phenomenon and incorporates the insights of the range of theories that have been proposed to date.

PRIME theory is an attempt to synthesize the insights contained in more specific theories into a coherent account that is set within a general theory of motivation. This chapter provides an outline of the theory. For the sake of conciseness, it is just an exposition – it delves only a little into the evidence and inferences that led to the development of the theory, or the theory's relationship with others in the literature. It is recognized that the ideas need to be expanded, developed, defended and related to other intellectual contributions on which it has drawn. This is attempted in the book, *Theory of Addiction* (West & Brown, 2013).

The theory is pitched at the psychological level of analysis but with a view to providing a 'pegboard' into which can be plugged theories at other levels (including economic theories and neurophysiological theories). When giving a psychological account of motivation, it is impossible to avoid making statements that just sound like common sense. The advance on common sense that is being offered here is bringing these ideas together in a coherent framework, together with non-common-sense ideas that have been developed through formal study and critical observation.

It is painted with a broad brush and does not attempt to capture what is known about the details of drug actions, social forces, and so on. However, it does seek to provide a coherent framework within which existing knowledge and future findings can be integrated.

## 1.3 THE HUMAN MOTIVATIONAL SYSTEM

PRIME theory is a general theory of motivation, this being defined as the brain processes that energize and direct behaviour. Before focusing on the structure of the motivational system, it is important to consider this in the broader context of behaviour. The proposed system fits usefully within a simple model that describes how capability, opportunity and motivation interact as a system to generate behaviour. This COM-B model takes a general form about the necessary conditions required for a behaviour that has been re-iterated over centuries in one form or another (be it legal systems or consensus meetings among behavioural theorists; Michie, van Stralen & West, 2011). In particular, a person must have the physical and psychological capability to enact a behaviour; they must have the physical and social opportunity to engage in it; and they must be more motivated by a course of action at the relevant moment than some other behaviour. This broad level of analysis serves as a reminder that 'motivational systems' do not exist in vacuums; systems do not become addicted to activities. There are factors beyond the motivational system – for example, knowledge and skills, and the social and cultural milieu which dictate perceptions and availability – that are crucial to understanding certain patterns of addictive behaviour.



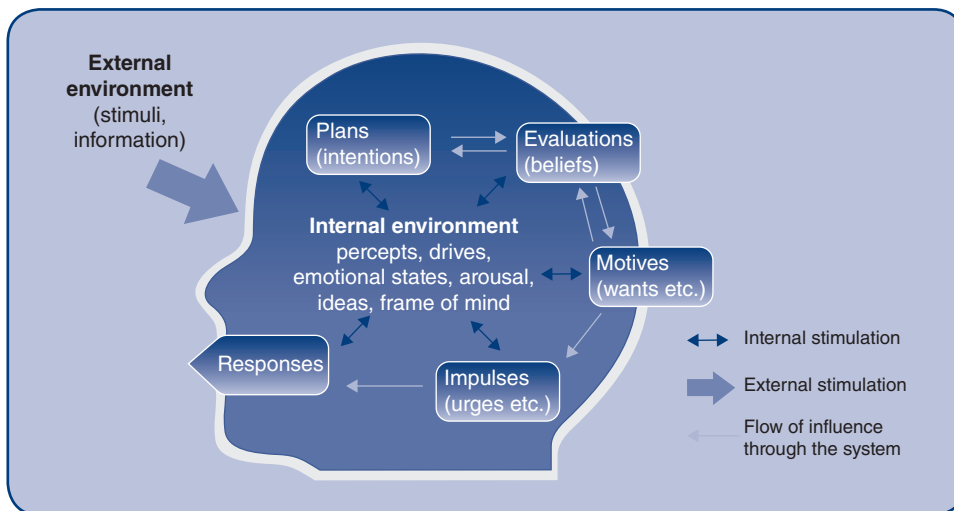
### 1.3.1 Structure of the Motivational System

According to PRIME theory, the human motivational system consists of a chain of five interacting subsystems whose initials make the PRIME acronym (see Figure 1.1).

The response subsystem organizes and executes responses. This involves starting, modifying or stopping actions. Responses can arise from reflexes – learned or innate, which are activated directly by internal or external stimuli – or from the output of the subsystem which generates potentially competing or additive impulses and inhibitions. At any given moment, it is the resultant force from this competition which controls our responses, notwithstanding a small subset of particular stimuli that can directly activate responses.

Impulses typically only enter conscious awareness when for some reason they are not immediately translated into action. They are then experienced as ‘urges’. It is not uncommon for a course of action to be impossible within an immediate environment, which is why people frequently experience urges. When available to consciousness, the strength can, in principle, be measured using self-report. Impulses and inhibitions are influenced by internal and external stimuli (see Section 1.4) and also by the output of the subsystem that generates motives (also known colloquially as ‘desires’).

The motive subsystem promotes a consideration of the possible consequences of different courses of action and thereby lies at the heart of purposeful behaviour. When entering consciousness, motives are experienced as feelings of want or need for that thing. Wants involve mental representations of something and associated feelings of anticipated pleasure or satisfaction; needs are feelings of anticipated relief from mental or physical discomfort arising from some actual or imagined event or situation. Wants and needs are influenced by internal and external stimuli, including reminders, physical sensations and drive states. Particularly important are



**FIGURE 1.1** Structure of the human motivational system

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generalized positive and negative emotional states such as happiness and sadness, which lead by association to targeted emotional states of liking and disliking. More than one motive can co-exist at one time. If motives do not involve the same course of action, then this competition will create a particular kind of generalized emotional state; a feeling of 'conflict'. This is unpleasant, and like any other adverse emotional state creates a motive to escape or avoid it. When motives co-occur, the one with the greatest valence prevails in generating an impulse or inhibition at a particular moment. This will then compete or combine with any other impulses and inhibitions that are directly generated by internal or external stimuli to start, stop or modify an action. Motives can also be influenced by the subsystem that generates evaluations.

Evaluations are a type of belief. Beliefs are conscious mental representations of the world that are propositional, i.e. expressed through language, as distinct from 'images' that are experienced iconically. The propositions reflect what an individual holds to be true, not true, or what might be true with varying degrees of likelihood, and have feelings of confidence attached to them. Uniquely, evaluations also involve a judgment about the extent to which a thing is also 'good' or 'bad'. Evaluations can be 'global' (generally good or bad), 'aesthetic' (pleasing or displeasing), 'functional' (performing well or badly), 'ethical' (right or wrong) and 'utilitarian' (useful or detrimental). Evaluations are generated by analysis and inference, and internal and external stimuli. Evaluations can only influence behaviour by producing motives, either directly or indirectly (via internal states like anger); they have no direct route to the impulse subsystem. Thus, believing an activity to be a good, or right, or useful thing to do, will not result in the corresponding behaviour unless it also produces a sufficiently strong feeling of wanting or needing to do so. Motives can input back onto evaluations; if a motive for a particular activity is strongly activated, this may cause a re-evaluation of the 'goodness' or 'rightness' of that activity. Evaluations are also influenced by the planning subsystem, which is most distal from the execution of behaviour.

Plans involve a future course of action, at least some degree of commitment, and a representation (however vague) of some starting conditions. Plans are most commonly formed when there is a motive to engage in an act but the time is not right at that moment. This may be because of competing desires or because the conditions when the act would be desirable do not yet exist. Plans are also formed when a course of action is immediately possible but sufficiently complex that plans are required to organize sequencing the behaviour. In each case, a plan will only produce behaviour at a later moment insofar that it is recalled. Remembering a plan at a time in which the starting conditions are met usually generates a positive evaluation of this act (the magnitude of which depends on the commitment with which the plan was formed). The alternative is that a plan is re-evaluated in light of new experience or other more salient current influences within the motivational system, and is thereby modified or abandoned. Insofar that this does not happen and the plan is evaluated positively, then this creates a level of desire to do it, which may generate a corresponding impulse. Whether or not the act is undertaken will depend on competing plans, evaluations, motives and impulses and inhibitions at the same moment.

## 1.4 INTERNAL AND EXTERNAL SOURCES OF INFLUENCE

### 1.4.1 *Drives, Emotional States and Arousal*

‘Drives’ (such as hunger) and ‘emotional states’ (such as happiness and distress, and liking and disliking) are of fundamental importance. There are a variety of drives, with the most well-known being homeostatic ones, such as hunger and thirst. These involve a motivational tension that is reduced by ‘consummatory behaviour’. Drives are affected by internal stimuli that signal physiological needs and external stimuli that amplify or draw attention to, or suppress or draw attention away from, them. Many drives are innate and common to all humans, but drives can also be acquired; for example, chronic exposure to nicotine from cigarettes leads to abnormally low levels of dopamine in the central nervous system whenever nicotine concentrations are depleted. Drives can produce direct impulses to engage in actions that reduce them, which have been learnt through experience. They can also produce impulses indirectly by creating emotional states (see below). Finally, drives can activate motives for courses of action that experience has shown to achieve drive reduction.

Emotional states are either ‘generalized’ (such as happiness and distress) or ‘targeted’ (such as liking and disliking). The cause of emotional states is complex, variable between individuals, and often difficult to introspect. Typically, they derive from the experience of stimuli/events that we perceive as affecting our well-being, the well-being of things we care about, our identity, and our sense of what is right and wrong. For many people, important determinants of well-being from one moment to the next are ‘hedonic’ experiences (pleasure and discomfort): things that give us pleasure tend to make us content, and therefore lead to liking, whereas things that cause discomfort tend to make us distressed and lead to disliking. Thus, targeted emotional states are generated by generalized ones – the difference is that they are directly attached to the mental representation of the perceived cause. Generalized emotional states can directly influence impulses, for example, an instinctive impulse to laugh or cry. They can also create impulses indirectly by acting as rewards and punishments through associative learning. Targeted emotional states lead to motives; most obviously liking leads to wanting and disliking leads to not wanting.

An important link between drives and emotional states is that changes in drive level can produce emotional states: drive reduction can be pleasurable, while an increasing drive or failure to reduce a drive can cause discomfort.

Arousal is the generalized level of energy in which the motivational system resides. The extent of arousal affects the sensitivity of all the elements within the system to other elements and external inputs, such as stimuli perceived by our senses. During arousal, relevant stimuli also become more likely to be perceived, as arousal also causes attention to become more focused. Arousal not only increases the sensitivity of all elements within the system, it also re-parameterizes the priority given to each

element of the system by other elements. For example, very high levels of arousal lead to interference by emotional states of analytical thinking being used to arrive at evaluations. The primary determinant of arousal is drives and emotional states. The relationship is bi-directional, which explains how the influence of emotional states and drives can quickly increase.

### **1.4.2 Self-Control and Identity**

We all hold beliefs and images about ourselves. These representations of self, and how we feel about them, constitute our identity. Identity only exists meaningfully when attention is drawn to it, and varies over time with experience, and different aspects will be variously coherent. Identity is a potentially important source of strong motives: aspects of our identity about which we feel strongly generate wanting, or even needing, to behave consistently with that belief or image of our self.

Self-control is defined as acting in accordance with a plan, evaluation or motive derived from a representation of our self in the face of competing desires, impulses and inhibitions arising from other unrelated sources. Self-control is therefore dependent on activating relevant aspects of our identity at the appropriate moments. The strength of attachment to the activated aspects determines the strength of the plans, evaluations, and ultimately wants and needs arising from them. Self-representations that are coherent and have clear boundaries, which mean that they are remembered and applicable to all relevant situations, will have greater control over behaviour. The exercise of self-control requires 'effort' that leads to depleted 'motivational resources' with continued expenditure.

## **1.5 THE DYNAMICS OF THE SYSTEM**

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### **1.5.1 The Moment-to-Moment Control of Behaviour**

The motivational system is fundamentally dynamic. In order for a subsystem to influence behaviour, it must do so through impulses and inhibitory forces operating at the time. However, outputs of a particular subsystem exist only when they are generated. This is equally true for 'higher' subsystems like plans and evaluations, as it is for motives and impulses. This places a greater emphasis on the immediate internal and external environment in controlling behaviour than theories which assume motives and impulses are transients but that other components (e.g. attitudes and self-efficacy) have enduring, trait-like, qualities.

Consistency in behaviour lies in more or less stable dispositions for components of the motivational system to respond in particular ways to particular (internal or external) stimuli. When these dispositions are enduring, they are considered to be traits and when they themselves are generated by current stimuli, they are thought of as states.

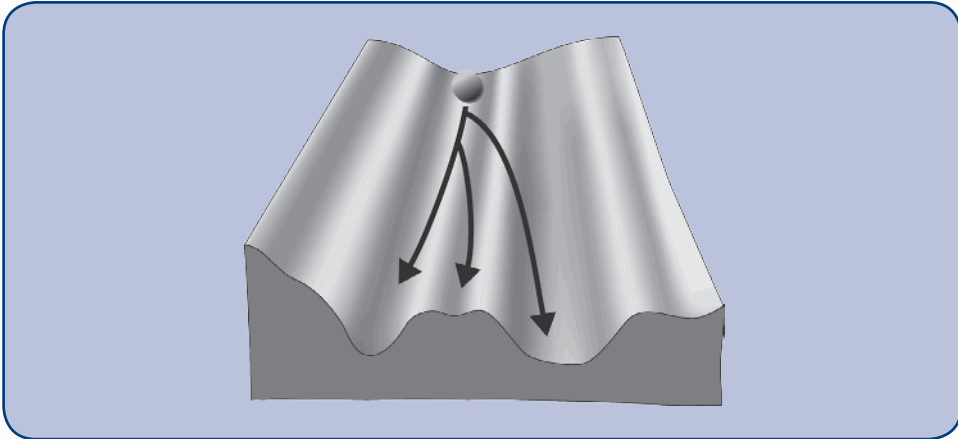
A key proposition – referred to as the first law of motivation – arising out of the moment-to-moment control of behaviour and the structure of the motivational system is that: ‘At every moment we act in pursuit of what we most want or need at that moment.’ This law recognizes that stimuli can produce impulses and behaviour directly without motives but concerns itself with deliberate behaviour by specifying the pursuit of action. Under this law of motivation, control over behaviour involves shaping these momentary wants and needs.

Identity is the source of self-control, and identity change is therefore posited to be a key starting point for deliberate behaviour change. Deliberate behaviour change is sustained when the desires arising from the new identity are stronger at each relevant moment than the desires arising from other sources to revert to the previous behaviour pattern, or are able to overwhelm habitual or instinctive impulses.

### **1.5.2 *The Unstable Mind and Chreods***

The human mind has evolved to be inherently unstable; the adaptive advantage is extreme adaptability, creativity and sensitivity to inputs and contingencies. The converse is that the system requires constant balancing input to prevent it from spiralling ‘out of control’ into maladaptive thought processes and behaviour patterns. This includes the motivational system, with the maladaptive patterns of behaviour representing addiction. For most people under most conditions, there are normally enough checks and balances in the system to ensure that it does not descend into these patterns permanently, but it is fiendishly complex to predict with confidence which inputs will lead the system to these maladaptive patterns, and indeed which would subsequently restore balance. Sometimes extreme one-off events are required to put a system into a very different state, whereas at other times a small innocuous event will be sufficient to send the system down a very different path at which point the checks and balances would maintain the new system. There are still other instances where a succession of small events is necessary and progressively leads the system to become firmly established in a new state.

These patterns can be understood in terms of the concepts of chaos theory (a mathematical approach to modelling complex systems, such as weather patterns) or ‘epigenetic landscapes’ (Waddington, 1977). In chaos theory, systems descend into relatively steady states over the short to medium term but can then switch, apparently unpredictably, to other violently unstable states, or even move in a pseudo-random fashion between them. The idea developed from the discovery that a minuscule difference in the initial parameters of a complex programme designed to model atmospheric conditions eventually leads to massive differences in output. This led to the famous notion of the flapping of butterfly wings in Asia potentially being responsible for storms in America. The ‘epigenetic landscape’ is a useful pictorial representation of these ideas (see Figure 1.2). The landscapes represent the state of a system at a given moment as the position of a ball on an undulating landscape, and potential



**FIGURE 1.2** *Example of an epigenetic landscape*

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future states that are represented by later positions on the landscape along which it is moving. The undulations or valleys of the landscapes (called 'chreods') vary in depth and shape and divide at critical periods. The path the ball eventually follows can be radically different as the result of a marginal difference in input at a 'critical period'. At later moments, considerably greater inputs can be insufficient to prevent the ball from continuing along a particular chreod.

A logical corollary of this perspective is that there are no stages to behaviour change. Or, certainly none that are linear and that can be assessed by simple questionnaires. Instead, motivation to change is much more unstable and responsive to the immediate environment. Thus, PRIME theory argues that the most effective use of resources is to put the maximum tolerable pressure on individuals to change at all available moments, rather than stimulating thoughts about what stage of readiness a person is currently occupying.

## 1.6 CHANGING DISPOSITIONS

The processes of change that operate on dispositions within the motivational system are drawn from the broad psychology literature. They include 'automatic' processes (not requiring, although not necessarily excluding, self-conscious thought), such as habituation (becoming less responsive with repeated occurrences of a stimulus), sensitization (becoming more responsive with repeated occurrences of a stimulus), associative learning (underpinning instrumental/operant and Pavlovian/classical conditioning), and imitation learning (mirroring a behaviour). Reflective processes tend to be based on explicit memory, recollected experiences can be subject to processes of inference (induction and deduction) and analysis (calculation, comparison, judgement and estimation).

## 1.7 TESTING THE THEORY

The first edition of *Theory of Addiction* presented the original formulation of PRIME theory and was published in 2006 (West, 2006). In the years since, a number of studies have been inspired by the theory, and a great many others have been used to interpret various findings relating to addictive behaviour.

A single-item scale of motivation to quit smoking was developed on the basis of PRIME theory to discriminate between differing levels of motives, evaluation and plans. In a large study of the English population, the scale was linearly and sensitively related to the likelihood of a quit attempt 6 months after the baseline assessment (Kotz, Brown & West, 2013). In a similar study, a simple self-reported rating of the strength of urge to smoke over the previous 24 hours was a better predictor of succeeding at stopping smoking than well-established scales based on patterns of consumption (Fidler, Shahab & West, 2011). This result supports the notion from PRIME theory that a repeated powerful motivation is the central feature of addictive behaviour, and that patterns of consumption are indirect symptoms; consumption is also determined by external factors which are liable to have (on average) less influence on the likelihood of success.

The multifaceted nature of motivation proposed by PRIME theory is supported by the unique contributions that enjoyment and dependence make to the process of smoking cessation. There is evidence that wanting to smoke arises from anticipated enjoyment and thereby deters even the attempt to stop while the day-to-day craving that arises from abstinence is dominant in determining the success once attempts have been initiated (McEwen, West & McRobbie, 2008; Fidler & West, 2011).

The relative influence of wanting, duty and intention in predicting quit attempts among smokers has also been examined (Smit, Fidler & West, 2011). The superiority of wanting over duty in predicting quit attempts supports the distal influence of higher-level constructs as postulated by PRIME theory. The theory is relatively agnostic about the relationship between duty and behaviour, and the study reported a negative association. Finally, the study also found that intention had an effect on attempts that was independent of desire. By contrast, PRIME theory argues that intention should be mediated by generating desires. However, the theory also argues that this mediation occurs in the moment in which a plan is enacted and is therefore undetectable by a simple two-stage longitudinal assessment of future plans at baseline and then later behaviour.

The chaotic nature and instability of the motivational system are reflected in a number of recent findings. Meta-analysis suggests that physicians are more effective in promoting quit attempts by offering assistance to all smokers than by advising smokers to quit and offering assistance only to those who express an interest in doing so (Aveyard, Begh, Parsons & West, 2012). Similarly, population surveys have reported that spontaneous or unplanned attempts to stop smoking are common – somewhere between a quarter and half all attempts – and appear to be associated with greater success compared with planned attempts (West & Sohal, 2006; Sendzik, McDonald, Brown, Hammond & Ferrence, 2011), at least among some groups of smokers (Resnicow, Zhou, Scheuermann, Nollen & Ahluwalia, 2014).



Finally, evidence for the importance of identity in the motivational system has accumulated. Positive smoker identity has proved to be an important barrier to making a quit attempt in the future (van den Putte, Yzer, Willemsen & de Bruijn, 2009; Tombor, Shahab, Brown & West, 2013). Considering the role of identity as a high-level source for generating strong desires to maintain behaviour change, one study found that there was a steep decline in the prevalence of a self-reported attraction to smoking and a smoker identity with the length of time a smoker had been abstinent (Vangeli, Stapleton & West, 2010). The implication is that smokers are more likely to relapse without the ongoing source of resolve provided by a non-smoker identity and consequently the existence of a smoker identity becomes rarer the longer people have successfully abstained.

## SUGGESTIONS FOR FURTHER READING

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