

Chapter 1

AN OVERVIEW OF THE THEORY

Most behaviour change is unproblematic. People's behaviour changes all the time, both in response to an ever-changing environment and their increasingly refined responses to it as they learn and adapt. This book is about trying to understand those aspects of human behaviour that aren't readily brought into concordance with environmental conditions and individual desires. It develops and elaborates a theoretical framework, called *CEOS theory* (I will explain the acronym later), which is designed to be a new and comprehensive way of thinking about how people change habitual behaviours. This involves understanding the constraints on and the potential of volitional attempts to change behaviour patterns that are under the moment-to-moment control of non-volitional processes.

The theory also focusses on the different processes involved in the initiation and maintenance of behaviour change. It is primarily designed to understand behaviours that are hard-to-maintain (HTM behaviours); that is, ones that while seen as desirable by the individual are not spontaneously adopted or are hard to sustain and/or are seen as undesirable and hard to reduce or eliminate in the long term. These behaviours include stopping smoking, eating healthy foods to maintain a desirable weight, exercising regularly and controlling alcohol consumption. CEOS theory also encompasses easy-to-change behaviour, where it is similar to many existing theories because there is less need to consider the conflict between volitional and non-volitional forces within the individual.

The focus of this book is on health-related behaviours. The big question it attempts to answer is: Is it possible to help people to enjoy and value healthy lifestyles, to the point where there is no longer any real effort involved in avoiding unhealthy and embracing healthy behavioural alternatives? Where this is not possible, can we develop strategies to help people maintain healthy options, at least most of the time, and to minimise unhealthy choices and to break unhealthy habits, even if it requires ongoing vigilance?

Key ideas and observations that have informed the need for a new theory include the following:

- People sometimes don't act in ways that are objectively in their best interests even when they want to change; for example, they continue to smoke or continue a high-fat low-exercise lifestyle even though they want to be fit and healthy.

- Even when people try to adopt healthy behaviours, these new forms of behaviour are difficult to maintain and are thus characterised by high rates of failure. The causes of these failures are not well understood, and attempts to reduce relapse rates have a bleak record.
- Recent research has established that the determinants of deciding and trying to change are different from those of maintaining behaviour change, at least for smoking [1, 2]. (See Chapter 2 for more details.) Some of the things that motivate smokers to try to quit, and which quitting improves, are associated perversely with reduced chances of success. It is not yet known whether similar perverse relationships are present for other HTM behaviours.

CEOS is a biopsychosocial theory, in that it postulates that behaviour is co-determined by the interaction between biological factors, modifiable aspects within the individual (psychological factors) and aspects of the environment, especially social factors. Which of these influences is most important for any particular kind of behaviour, or as is the case here, which make it difficult to maintain desirable behaviours, is an empirical question.

Within the individual, engagement with the environment is maintained by a complex multi-level processing system that relates environmental inputs to need states of the individual, leading to behaviours designed to reduce those needs [3, 4]. Emerging from the higher levels of this system is the unique human capacity to represent the world outside of the moment and to operate on conceptualisations of it using language and rules. This representation of the world can encompass aspects of the individual doing the representing, and thus becomes self-referential, and it has the power to influence behaviour in novel ways. The capacity to influence behaviour based on a conceptual understanding of the world is a top-down process, unlike the bottom-up process of dynamic adaptation to the environment that characterises other aspects of behaviour.

The core-characterising feature of CEOS theory is that these two processes (Figure 1.1) constitute two fundamentally different ways of relating to the world, and many of the problems of human behaviour can be better understood by considering them as co-occurring and in some cases competing systems within the individual. The base system that is reactive to environmental conditions I call the Operational System (OS) because it is the system that operates directly on the world to maintain homeostasis. The term is used in computing to cover those routine functions that are automated, that is, are done without executive (external governing) input. The emergent, reflective, self-referencing system that acts on conceptualisations of the world I call the Executive System (ES) because it operates in much the same way as the executive of an organisation works; that is, by setting the goals for an organisation that can only be achieved if the organisation is sufficiently prepared to work towards them. The name CEOS is an acronym for Context, Executive and Operational Systems, which are the core elements of the theory. CEOS is one of a class of dual-process theories [5, 6], which make similar, but not identical distinctions between volitional and non-volitional processes.

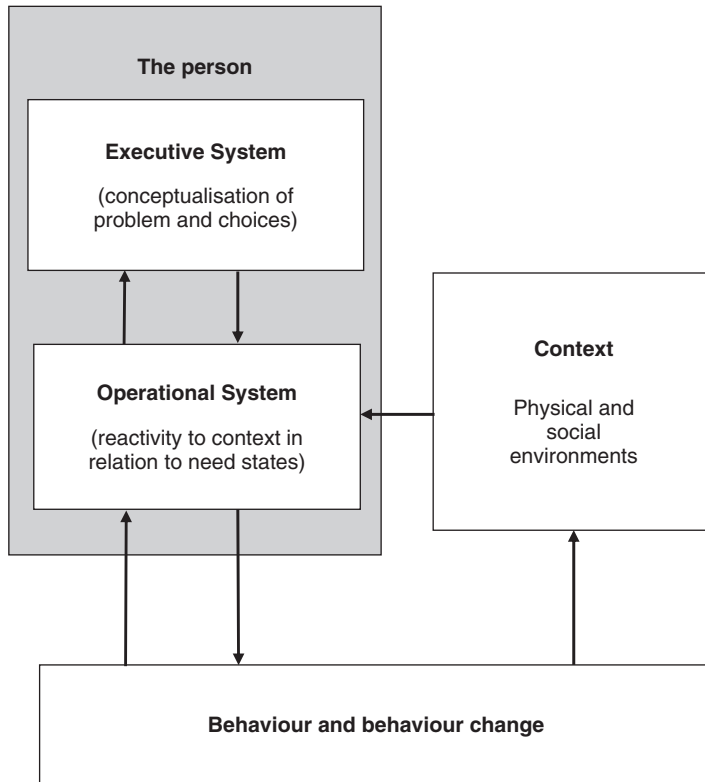


Figure 1.1 Simple diagram showing the three main influences on behaviour change.

The OS is where all behaviour is generated and controlled. The OS is reactive to the environment of the moment, its current states and inputs from the ES. It adapts through associative mechanisms typified by habituation and conditioning. By contrast, the ES uses inputs from the OS and from language-based representations of the world to evaluate ongoing behaviour, and to either resolve conflicts between OS tendencies to act or pursue articulated goals that emerge from its conceptualisation of the world or of possible futures.

Reframed in dual-process terms, the challenge that this book addresses is why, once the ES decides that behaviour needs to change, it is sometimes so difficult to enact that change and to maintain it. CEOS postulates that this is because the OS tends to favour or revert to well-learned routines when not being explicitly directed to do otherwise, and indeed will not respond to ES directives unless suitably primed. Priming involves acting to generate affective associative links to ES ideas so they also become action tendencies within the OS, and thus if strong enough, compete with other operational action tendencies to be enacted. This priming is necessary because the ES cannot act without the OS accepting the behavioural schemata or script from the ES as ‘its own’. The capacity of ES processes to inhibit action tendencies

is easier to achieve than building the strength for action tendencies to impel action as inhibition requires lower levels of activation than for exciting action.

Emerging out of the characteristics of the two systems, and central to this book, CEOS postulates that different processes are involved as a person progresses from unconcerned acceptance of one behavioural pattern to the stable adoption of a more desirable alternative; in particular, the determinants of the initiation of change are quite different from those involved in maintenance and this is most clearly manifested in HTM behaviours.

CEOS is a framework (or meta-theory) for integrating a range of micro-theories that help us understand the key component tasks involved in complex behaviour change and how they interrelate. As such, it encompasses descriptive theory (taxonomy), theories of mechanisms and theories of how to intervene. As part of the theory of how to intervene, it includes a model of how a person might best conceptualise a problematic behaviour to optimise his/her chances of successfully changing it.

The theory is designed to explain why some behaviours are hard to reduce or eliminate and others are hard to sustain. It is argued that while there are some similarities with both hard-to-reduce behaviours (such as smoking) and hard-to-sustain behaviours (such as dietary change), there are some important differences, particularly in the role of cues and the role of negative experiences.

The theory was developed with the persisting problem of tobacco smoking as the primary focus. As a result, most of the examples used come from the challenges associated with smoking cessation. However, it has been conceptualised to apply to all HTM behaviours.

Before beginning to elaborate, I provide some background on the conceptual and empirical underpinnings, which together justify the need for a new overarching framework.

Context

Science-based approaches to understanding HTM behaviours are by no means the first societal efforts to encourage us collectively to do what the society sees as desirable – it is one of the enduring projects of human civilisation, involving governments, religions, communities and families. A lot can be learnt from the successes, part successes and failures of the past.

Dual-process theories are also not new. Their origins go back to antiquity [7]. They include the Buddha's analogy of the rider and the elephant and Plato's analogy of the driver and the chariot. More recently in the early days of modern psychology, James [8] made a distinction between experiential and analytic processes, Pavlov [9–11] identified his first and second signalling systems as mechanisms for these two kinds of processes to work, and Freud conceived of the structures of the Ego and Id as the framework within which this interaction occurred, mediated in his case by the Superego [12]. These are all dual-process models of one kind or another. They are all about trying to understand why humans sometimes have trouble doing what they think is best, sometimes described as taming our animal selves.

Within empirically grounded (scientific) psychology, these ideas were rejected by the influential behaviourist movement (e.g. Watson and Skinner) [13–15]. Behaviourist models postulate bottom-up processes by which environmental conditions interact with motivational (drive) states of the organism to determine behaviour. However, as the limitations of behaviourism became apparent for explaining higher cognitive processes, they were replaced by a cognitivist movement that largely ignored lower level processes, implicitly or in some cases explicitly, assuming that these could be controlled in a top-down way by higher cognitive processes. It is the observed limitations of rationality-based cognitive theories that have led to CEOS, and to experimental social and cognitive psychologists re-exploring the role of lower level processes in influencing human cognition and, less researched, behaviour. I was unaware of some of this experimental work until quite late in the development of the theory (and there may be more of which I remain ignorant), but it is reassuring that it is all consistent with the broad theory proposed here, and in a couple of cases has allowed me to refine elements of it. Canvassing the experimental literature has also renewed my concern about the parochial nature of much research and the tailoring of theory to the micro, rather than looking for theories with applicability beyond any specific research stream. I believe that it is important to begin by thinking about human behaviour in totality, and to build models within each domain of enquiry that are consistent with those that are more broadly applicable. CEOS is not the only attempt to do this, other examples include the PRIME theory of West [16, 17], which does not take a dual-process approach, the dual-process approaches of Strack and Deutsch's [18] RIM model, particularly as elaborated by Hofmann *et al.* [19] and the Nudge theory of Thaler and Sunstein [20], which focusses on communication strategies and environmental change to influence behaviour. The relationship of these models to CEOS is illuminated at various points in this book.

Limitations of the existing theories

We need a new overarching theory of HTM behaviours because existing theories have major limitations, either in scope or in their conceptualisation of the central problem.

Three sets of theories have dominated attempts to change problem behaviours: theories of addiction that focus on biological mechanisms, including learning theories that are concerned with the malleability of biological determinants of habits; expectancy-value theories that emphasise the rational appraisal of the balance between the costs and benefits of behaving, given the existing social and environmental contexts; and social determinant models that postulate that mal-adaptive behaviours are the result of imperfect social structures (i.e. problems with the environment). Each of these focusses on one aspect of the totality, and it is apparent that each is too limited to deal with the complexity. See West [16] for an excellent review of many of these theories, including identification of

their limitations). To get a better idea of the applicability of these theories, consider the three case studies given in Box 1.1 before you read on.

Box 1.1 Case studies of obesity

Consider three cases studies of the same problem – serious obesity – and from the information given; see what you think is responsible and what sort of strategies you might consider to help the women concerned. All three are excerpts from the stories of severely obese women of early middle age, each of whom live with her husband and children.

Case A: This woman comes from a family that is also obese. She had a happy childhood but ate lots of snack foods and sweet drinks. The area of the country in which she comes from has a history of poor diet and has the highest levels of obesity in the country.

Case B: This woman lives with her family in a different town to her parents and socialises mainly with her husband’s family and friends, with whom she gets on very well. She is the only obese person in her friendship network. However, both her parents and several relatives are also seriously obese. She eats a very similar diet to her husband who is normal weight.

Case C: This woman had a stressful adolescence, whatever she tried at she failed and she came to see herself as someone who could not manage herself. She became severely obese in her adolescence and has been unable to keep weight off since. She is very reliant on her husband for advice and often unwilling to take independent action. Most of the people around her are not overweight, including her husband.

As you read Case A, you are likely to be drawn to the social context. Living in those conditions, how could this woman be anything other than obese, clearly the environment is the problem. However, for Case B, this story does not mesh, as she lives with slim(ish) people and doesn’t seem to be doing anything wrong; perhaps hers is a case of a biological predisposition. Then, take Case C, who clearly has self-esteem problems and probably has low self-efficacy for change, and perhaps is a candidate for a psychologically based approach.

Now, what if I were to tell you that all three are parts of the same woman’s story. Could it be that elements of all three approaches (theories) are right?

This example brings to mind the parable of the blind men and the elephant. A group of blind men are taken to the zoo and get to meet an elephant close-up. One gets to feel the trunk, another the leg, a third gets to run his hands down one side, and a fourth gets to feel the tail. When comparing their experiences afterwards, they all have completely different ideas of what an elephant is (like a wrinkly snake, a tree trunk, a wall and a rope), and in a narrow sense all are part right, but all are wrong in totality. We can learn from each perspective, but need to have a view of the whole to fit them together. If we then want to focus on one part, we can better understand how it fits into the whole.

At one extreme, social determinist models seem to assume that addictions and other undesirable behaviour patterns are a symptom of societal malaise, and that they will disappear if we reform the society. They point to the powerful influence of societal structures, and the differing rates of health problems in different societies to argue their case [21]. Along with West [16], I see that the main limitation of these theories is that they cannot readily account for, let alone predict, the demonstrated influence of individual level factors. Why do individuals (seemingly) exposed to the same social context turn out differently? Social determinist models often accept a role for biological factors, if only to explain individual variability, usually implied to be pathological, but often consider any form of psychological or behavioural processes to be of limited importance [21, 22]. A more productive way of theorising social factors are social ecological models [23], which leave a place for intrapersonal factors, although they do not generally pay much attention to them. Social factors are particularly important for problematic behaviour patterns that are widespread, but only provide a partial explanation of HTM behaviours as they typically continue to occur in the face of increasing social pressure to change. A complete model needs to be able to encompass these factors and the social–ecological models can be readily integrated into the ideas presented here (see Chapter 4).

Biological models of addiction fall into several types, including disease models that postulate the breakdown or lack of some important biological mechanism that makes the individual susceptible to under-regulation of the problematic behaviour and natural variation models that postulate a continuum of vulnerability. For example, the balance between inhibitory and excitatory pathways in the brain is a major determinant of individual differences [24, 25]. Additionally, there are theories about the extent to which the behavioural manifestations of biological factors are modifiable. This book is about those problems that are at least partly modifiable by the actions people take, even if they only mitigate rather than completely solve the problems. For example, an obese person may be able to become less obese, but never gain normal weight. I suspect that in other areas, the fixed biological component of variability in behaviour or outcomes is lower than it is for obesity. I am also of the view that we should never concede that there is nothing we can do, or it will become a self-fulfilling prophesy. Where some modification is possible, then it is important to focus on what can be learnt to maximise the desirable change.

Learning-based theories focus on the relationships within the person's micro-environment, and on immediate contingencies, to explain both the process of development of bad habits and the difficulty of reversing them, with biological factors postulated as key determinants of the variability of effects. There are also some differences between these theories as to whether the focus is on learning new skills or on overcoming inappropriate habits (an issue on which I will have more to say later).

Interactions between biological and environmental factors are recognised as important in some areas, most notably weight control, where notions about people's metabolisms being set or reset for feast or famine being a major determinant of propensity to obesity are receiving strong empirical support, not only by identifying genetic mechanisms by which this occurs [26], but also by showing

how early experience, including in-utero, can lead to these settings being changed [27]. These kinds of phenomena may set limits on what sorts of behaviour change are possible, and they certainly affect the relationship between behaviour and its consequences. For example, a person whose metabolism is set to famine needs to constrain his/her diet much more to achieve a normal level of weight than a person with a body set for feasting.

The final set of theories focus on cognitive processes and have been the most influential within the field of health psychology. They are typically grounded in human rationality, for example, expectancy-value theories, which see behavioural choice as a joint function of expected consequences of acting and the values attached to each of the anticipated consequences. Relevant theories here include the theory of planned behaviour [28, 29], the theory of trying [30]; the Health Beliefs Model [31–33]; the Transtheoretical Model (TTM) [34, 35]; and more recently, ASE, now renamed I-Change Theory [36, 37], HAPA Health Action Process Approach [38]; and the Rational Addiction model [39], which is highly influential in some areas of economics (see West [16] and Webb *et al.* [40], for other relevant theories). All the above-mentioned theories view intention to change behaviour as in part determined by the decisional balance between the costs and benefits of change, or alternatively of the existing behaviour pattern.

A favourable decisional balance does not automatically lead to behaviour change. For example, many smokers and overweight people know that changing the relevant behaviours is in their best interests, yet they have not changed. Neither is lack of motivation a sufficient explanation, as many have tried repeatedly to change. Something else is going on. Bandura [41–43] tackled this problem with his conceptualisation of self-efficacy, that is, the person's sense of his/her capacity to enact the change.

All of the above theories include versions of self-efficacy, with some focussing on it having a role beyond intentions in the move to action and in maintenance of change. HAPA theory [44] is the most sophisticated, in that it postulates different forms of self-efficacy for initiation, maintenance and recovery from setbacks. The need for any form of self-efficacy implies processes that operate independently of deliberative decision making but which are modifiable by self-regulatory activities, that is, self-efficacy mechanisms, but Bandura does not elaborate much on what these are, and neither do any of the other theories. Bandura [43, 45] does at least provide some ideas as to how behaviours can be formed, with his identification of the importance of vicarious learning or modelling as means by which the skills to engage in new tasks can be developed independent of or in conjunction with trial-and-error attempts to perform them. However, in most cases, acquisition of the necessary behaviours is not the issue; much relapse back to old behaviours happens after some time, after the new behaviours involved can be thought to have been mastered (at least to a basic level of competence). A learning-based theory would suggest that this failure to maintain change is due to overlearning of the inappropriate behaviour pattern as a result of immediate positive contingencies (e.g. the pleasure of puffing on a cigarette or eating a cream cake). Such an explanation suggests that the immediate consequences of action might play a more important role

than delayed consequences, a point picked up by Hall and Fong [46] and common to basic economic theories of behaviour: value is discounted as a function of time. This suggests that decisional balance approaches need to consider the temporal dimension of the consequences that are weighed up.

Cognitive theories have also tended to focus on the determinants of choices or the initiation of action, often operationalised as intentions and plans, and assume that all that is required for the maintenance of change is more of the same; that is, they are based on the assumption that the influences on behavioural choices are the same as those affecting long-term maintenance of those choices. The TTM and HAPA are notable exceptions here, but their elaboration of what is required for the maintenance of behaviour is far less developed than for what is involved in the initiation of behaviour.

Another important and related development has been a focus on self-regulatory or self-control processes following the work of Carver and Scheier [47, 48], Baumeister and colleagues [49] and more recently Hall and Fong [46]. These theories focus on what needs to be done to control impulsive behaviour, but are rather less developed about how to change the nature of the impulses and thus the likelihood of behaviour, except via self-control-related mechanisms. In this regard, they can be thought of as alternative conceptualisations of Bandura's [43] ideas around self-efficacy.

Further, most cognitive theories ignore the role of emotional factors. The most notable exception is Leventhal's perceptual-motor theory, now elaborated as the common-sense model [50, 51], which has been influential in understanding reactions to illness, but has been undervalued in health behaviour change. Leventhal focusses on the implications of how emotions are evaluated, an important issue for understanding the maintenance of HTM behaviours.

More recently, theorising has emerged out of research on distortions of optimal decision making that takes emotion and other factors that affect rational decision making seriously [52–57]. For example, framing of possible outcomes in terms of gains or losses affects the choices individuals make. People tend to take risks in search of low-probability high gains (e.g. lotteries), but are averse to risking large losses (thus they use insurance) [56]. One approach to understand these non-conscious influences has been to postulate non-conscious implicit versions of conscious attitudes and beliefs. However, it is known that non-conscious evaluative processes can operate faster than conscious ones [58], suggesting that implicit beliefs are not functionally equivalent to the consciously elaborated ones, as if they were, one would expect the same amount of processing to generate them and thus there should be no speed advantage.

Thinking has changed to acknowledge the evidence that the unconscious processes that affect decision making operate in quite different ways to conscious reasoning, and thus to postulate dual-process models [6]. As noted earlier, the ones most similar to CEOS include RIM theory [18], later versions of Prospect theory [56], and the related, but more comprehensive Nudge theory [20] that focusses on use of communication and environmental change strategies to help reduce biases in decision making created in part by emotional or reactive influences distorting

rational choice processes. Dual-process theories seem to divide [5] into those that focus on how unconscious processes shape reasoning, and those more concerned with parallel competing processes, for example, Petty and Caccioppo's [59] distinction between systematic and heuristic processing. The former is closest to the duality proposed in CEOS. The importance of competing processes in relation to strategies for persuasion is discussed in Chapter 5.

The theories that focus on unconscious influences on reasoning parallel CEOS, and in some cases elements from them have been borrowed, especially when focussing on aspects of decision making. A key difference between CEOS and many of these theories is that they focus on the ways non-conscious processes interfere with conscious decision making, while CEOS is more interested in the limits and possibilities of executive processes to change undesirable behaviours, given that they are primarily under the control of operational processes.

The empirical work on which dual-process theories are based includes studies on biases in reasoning about computationally known outcomes/events (e.g. problems in logic). As we will see, there are reasons to believe that some of the heuristics that distort decision making in these cases may actually increase the adaptive value of choices in situations when outcomes are probabilistic. For example, feeling of discomfort can indicate that decisions have not taken into account important factors or mis-weighted them.

Cognitive theories are quite good at predicting decisions to try to change and the initiation of change, but they do less well when used to predict longer term outcomes. There is increasing evidence that some key determinants of the initiation of behaviour change can, at least for quitting smoking, play quite different roles in maintenance [2]. For example, in one study, colleagues and I found that wanting to quit, one of the strongest prospective predictors of making quit attempts, was inversely associated with maintenance among those making attempts [1]. That is, the more you want to quit, the more you will try, but the less likely you will be to succeed on any given attempt. Findings like this make it critical to consider the possibility that initiation and maintenance of behaviour involve quite different processes. We need better theories of maintenance.

The most detailed attempt to understand maintenance is Marlatt's [60–62] theory of relapse. It has been complemented more recently by Rothman's [63] distinction between expectancies being the primary influence on initiation, while experiences affect maintenance, and Piasecki and colleagues' [64] tripartite model in which physical withdrawal, stressors/temptations and cessation fatigue make time-shifted contributions to relapse risk. Marlatt and associates take a system-oriented approach, which is largely consistent with the approach taken here. They see environmental cues as key determinants of relapse, along with internal processes, most notably what they call the Abstinence Violation Effect, whereby negative affective evaluations around a single instance of the old behaviour generate relapse. The empirical evidence for this latter effect is not strong; so, there is a need for different mechanisms to explain the fact that lapses commonly trigger full relapse. Beyond this, their theory is largely descriptive, spelling out likely determinants of relapse, rather than specifying how they operate.

Negative experiences clearly predict relapse [65]. However, many of those who change report feeling better overall and net benefits of change [65–67], yet relapse [68, 69]. It appears that relapse has more to do with negative feelings associated with the new behaviour than the overall tenor of experience. Piasecki *et al.*'s [64] three factors are all important, but a range of other factors are missing, such as what leads to greater withdrawal.

The limitations of taking any one of the above-mentioned theoretical approaches in isolation are becoming most apparent in the area of tobacco control, perhaps because this is the area with the most research. Environmental factors are clearly important. For example, the prevalence of smoking has declined markedly over a period of decades in countries that have systematically tried to discourage use, such as Australia [70]. However, theories that focus on social determinants are moot when it comes to understanding individual differences in quitting success, or more generally why some people continue to smoke and others have given up, except to the extent that they belong to identifiable social groups who are disadvantaged in ways relevant to the persistence of smoking. Help either in the form of quit smoking medications or effective cognitive behavioural counselling results in higher success rates. Further those seeking help tend to be more successful than those who are proactively recruited to try to quit [71]. Both these suggest that elements of motivation and skill are both important. Unfortunately, at this point, our ability to predict relapse is otherwise poor.

Most smokers want to quit and nearly all acknowledge the adverse health effects and that they would be better off if they did not smoke. Their continuing smoking is not for lack of trying to quit. On an average, smokers make around one failed quit attempt a year and at least as many more plans to quit are aborted [71]. The most recent attempt is for a majority not their longest; thus, there is no clear tendency for attempts to get longer before finally succeeding [72]. Inconsistent with learning-based theories, quitting smoking does not seem to be something that people get better and better at before finally succeeding. Further, as noted earlier, aspects of motivation to quit, which are strongly predictive of making quit attempts, are inversely related to success among those who try [1]. These findings are hard to explain. It could be that those most motivated to quit are using relatively ineffective strategies, or they are smokers for whom quitting is genuinely more difficult: if they want to that much and keep on trying and failing; it is very plausible that the task is too hard, they are and heavily addicted. Both explanations point to these smokers needing more effective help.

The above-mentioned analysis suggests that failure to change can be thought of as due to the strength of operational processes supporting the addictive behaviour (genetic or acquired, often thought of as the core of addiction) being stronger than self-regulatory capacity (some combination of poor strategy and lack of self-control) and perhaps interactions between the two. This raises the question of whether a person's beliefs about his/her level of addiction can provide feedback to increase the strength of operational processes that underpin the addiction, and similarly whether different forms of thinking could lead to reductions.

Core elements of CEOS

CEOS has a major focus on the role of non-cognitive (or non-language-based) functions as well as on cognitive functions. It deals specifically with the reality that prolonged periods including multiple attempts are potentially required for the stabilisation of behaviour change, things cognitive theories neglect and which are critical to understanding change. It also considers the way volitional forces interact with non-volitional ones, concepts adapted from self-regulation models [47, 48]. CEOS is designed to be both a theory of self-regulation in the face of difficulty, and of how agents can act to modify both contextual and conditioned factors to reduce self-regulatory demands and automate, as far as possible, desired behaviour patterns. At the core of CEOS is the idea that the person is best conceptualised as consisting of two interrelated systems that jointly, in conjunction with environmental contingencies, determine human behaviour (Figure 1.1). As noted earlier, the two systems that are at the core of CEOS are the OS and the ES. Some key features of the two systems are listed in Table 1.1.

Within the individual, the OS is the locus of action. The OS is reactive to the environment and functions through associative mechanisms typified by conditioning paradigms. It is hierarchically organised and faster acting when it does not need to engage higher levels of the hierarchy in decision making. It can operate independent of conscious awareness, and indeed it operates more efficiently this way. It is primarily influenced by environmental contingencies in relation to its internal settings: innate, acquired and dynamically changing (e.g. hunger and desire for stimulation) and of relationships between the organism and the environment (e.g. perceived threats). I prefer not to describe it as impulsive [18, 19] as this implies that it acts in ways that are not in the person's best interests. The OS has developed to be adaptive, but it does not operate by logical analysis.

Table 1.1 Core-defining characteristics of the two systems

Operational System (OS)	Executive System (ES)
Primary determinant of behaviour	Decisions to behave only result in action if consistent with OS action tendencies
Bottom-up processing	Top-down processing
Processing occurs automatically, much out of consciousness	Conscious of OS inputs, memories, goals, beliefs and some steps of processing
Reactive to environment	Can be reflective, proactive and deliberative
Generates action to reduce discrepancies between current and target need states	Can also act to achieve progress towards linguistically encoded goals for the future

The ES uses inputs from the OS and from language-based representations of the world and can apply rule-based logic in pursuit of articulated goals. It is largely conscious, and is, or can be, goal directed and rule governed. In evolutionary terms, the ES emerged out of higher level functioning of the OS. It analyses inputs from the OS, memories of events and ideas. Its original function was to resolve conflicts within the OS, acting as a higher order part of the OS. The capacity of language has transcended that original goal, thereby enabling alternative paths to be pursued (to those evoked by OS processes). The ES uses conscious deliberation via language to build stories (both explanations and justifications), which it can use to decide on actions which, in turn, act as stimuli for the OS to act. It generates action tendencies in one of two ways: either referenced to goals that have either emerged from the stories and expectations it has produced and/or from processing to resolve competing action tendencies that are referred up from the OS. The ES is the locus of whatever self-regulatory capacity the individual has [47, 49]. The primary role of the ES is as a problem solver, not a long-term monitor and self-regulator. It works best when it can ‘delegate’ long-term tasks back to the OS (i.e. automate them), including the institutionalisation of behaviour change.

All behaviour is implemented through the OS, and all but some of that which is experienced as volitional is actually initiated by it. The ES, in an analogous way to the CEO (Chief Executive Officer) of a large company, only sets the broad agenda. The ES acts through the OS; so, lower level action tendencies need to be compatible for ES-generated action tendencies to result in behaviour. The ES has no independent capacity to generate action, but can act to inhibit or stimulate action tendencies of the OS, which combined with other inputs on the OS, can tip the balance in determining what the person will do; that is, the ES can try to get the person to act or not, but is dependent on the OS being responsive to determine whether its intentions are enacted. This corresponds with the company CEO who exercises some control over what the company does, but only within limits he/she, if wise, knows not to exceed. The company has to be ready to act on CEO directives or a process of convincing the organisation of the need for the change is required. The analogy becomes strained because the OS controls what the ES perceives in ways the company cannot for the CEO. The CEO has some capacity to perceive independently (i.e. go out and form independent views, something that is common when a new CEO is brought into an organisation from outside).

The formation (or existence) of independent views by the CEO is, however, in some ways analogous to a person adopting a new story to try to explain his/her current situation and thus what he/she need to do. Part of the utility of this analogy is that systems theory has demonstrated direct equivalences between comparable elements at different levels of systems [73]; so, seeing the operation of the OS through the eyes of how an organisation operates allows us to see, through an analysis of these mechanisms, analogues of aspects of OS functioning that are hidden within the individual, that is, are not directly accessible by our ESs. Thus, the analogy may also encourage a more systematic understanding of similarities and differences between the functioning of organisations and individuals.

Viewing the relationship between the OS and ES using different analogies can provide different insights. An alternative analogy is of the rider (ES) on the elephant (OS) [7]. The rider needs to work with the elephant as he/she cannot force it to act as he/she wants. Thus, he/she has to cajole and reward the behaviours he/she wants until the elephant comes to want to respond to the prompts of the rider as if this is what it wants. This analogy may make it easier to think about the collective outputs of the OS, but the organisational analogy is more useful for helping to think through the mechanisms by which the OS works and influences the ES. One area where the elephant analogy falls down is that the OS has greater direct influence over the goals of the ES than the elephant does over the rider. The elephant influences the subsequent actions of the rider through its behaviour, while the OS both does this and also influences the ES directly through internal signals it passes up about its internal states and what it attends to in the environment. The elephant has less influence over what the rider perceives.

Conceptual underpinnings

The central reason for reconceptualising human behaviour as the interaction between two systems rather than of one complex system is the extraordinary nature of the change in potential that occurs once behaviour can be directed towards the attainment of future goals, instead of being confined to optimisation of action in the present. Goals are ideas about the future that can guide action. They can range from simple choices, through to life goals [74].

CEOS is grounded in a form of emergent materialism [75], in that it postulates that virtually all behaviour and all experience has biological underpinnings, but that the complexity of the organism results in novel properties emerging (Box 1.2). These novel properties are encapsulated in the emergent functionality of the ES. There is a brief discussion about the biological limits on what may be possible for the ES to achieve towards the end of this chapter.

CEOS postulates that sensory inputs affect behaviours, including volitional behaviours, independent of their representation in consciousness as well as via conscious awareness [58]. Consciousness is only required for ES-directed activity. Some OS-controlled activity is monitored by the ES, and at other times, the OS is primed to trigger the ES to attend by such things as the novelty of the situation, uncertainty about appropriate action or specific situations the ES has cued the OS to alert it to. Where ES input is available, it can act to override OS tendencies or make a decision that resolves OS uncertainty, but to generate behaviour, it needs to prime the OS to generate appropriate action tendencies.

All advances in knowledge and most human cultural activities are attributable to the ES (experienced as our selves). Even artistic endeavours require ES direction informed by OS impulses (Box 1.3). A person's identity is the way they are represented in the ES's conceptualisation of self in the world. Humans have the capacity, through language, to build a conceptual model of the world in the form of stories about it (things scientists call theories) [76] that has given them the capacity

to mould many aspects of the world to their ideas. These conceptualisations (or stories) can be relatively invariant in the face of the ever-changing flow of experiences generated by the interaction between environmental conditions and internal states. They can also shift suddenly under conditions where one story is abandoned in favour of an alternative. The ES has the capacity to guide action in ways that reflect these stories, rather than in ways that are determined by the situation and the related conditioned responses, or innate action tendencies, that is, the factors determining OS-based action. Consciousness is essential for ideas to form, and for them to exhibit continuity in the mind and, moreover, this continuity is necessary for executive capacity to emerge. Consciousness creates the conditions for genuinely goal-directed behaviour because it allows the development of a model of what might happen in future, considered in the present moment, and the goal becomes the main proximal determinant of action [74]. The existence of goals gives the appearance of the future determining the present, but the goals actually exist in linguistic space and precede the actions they stimulate. Or as Bandura [77] put it:

The capacity for intentional and purposive action is rooted in symbolic activity. Future events cannot be causes of present motivation and action. However, by being represented cognitively in the present, conceived future events are converted into current motivations and regulators of behaviour. (see p. 248)

Box 1.2 Emergent materialism

Emergent materialism [75] postulates that virtually all behaviour (except pseudo-behaviours like falling which can be determined by physical forces alone) and all experience has biological underpinnings, but that the complexity of the organism results in novel properties emerging. Experience is an emergent property of biology, while behaviour is mainly an emergent property of the interaction between biology and environment (context). Behaviour, however, can also be produced directly by biology (uncued behaviour), or purely as a result of physical forces (e.g. falling, the direct effects of being hit or pushed), although we often do not consider such events as behaviour. While experience needs to be able to be explained in terms of biology, this can only happen after the event. As such, for any predictive analysis of experience (beyond general tendencies), a higher level of analysis is required – specifically one that references experiences and their relationships with other aspects of the world people interact in. This is why it is wrong to argue that once biological correlates of some behaviour or experience are discovered that psychological explanations become redundant. Understanding the biological underpinnings may allow our thinking to become more refined, and certainly more grounded, and it can lead to biologically based strategies for changing functioning, but ultimately it cannot provide a complete explanation of why people behave as they do.

Box 1.3 An author's reflection

This book is (necessarily) written from the perspective of the ES, the subsystem through which people consciously reflects on their lives. Our challenge is to understand (inevitably using volitional processes) the roles of the non-volitional processes on which the volitional system is built and elaborated because it is the OS that constitutes the main limitation on our (ES) capacity to act as we would ideally like to do (along with tangible environmental constraints). Because a subsystem cannot completely stand outside itself, it means that we cannot have direct knowledge of the genesis of our consciousness. Further, the ES does not have an unbiased or uniformly privileged view of the OS. Godel's theorem demonstrates that any self-referential model or theory is necessarily incomplete; that is, there are some things that are true that cannot be explained by the theory. I take this to mean that as self-reflective beings, there will always be some uncertainty in the ways we relate to the world.

Even if we could collect all the information we identified as being needed to solve a problem, collecting it would change the world; so, even then our knowledge would either be incomplete or out of date. We are fated to live with uncertainty, but we should at least be able to roughly map out the limits of what we can know, and increase its fidelity with the underlying reality, even though it will never be complete. Increased understanding cannot be achieved by reasoning alone, it requires continuous engagement in a process of experimenting with reality to complement our theoretical understanding (a scientific approach or its day-to-day analogue of reflective action). If we are to better shape the way our ES engages with the world (i.e. self-regulate), part of our increased understanding needs to be of the sorts of influences OS processes and levels of functioning can have on executive functioning, both those signalled to the ES and those that have effects in other ways. This understanding is needed for thinking about the kinds of ES processes and environmental influences that could be modified to influence OS processes in ways that enhance the probability of desired actions.

Thus, ES goals (i.e. consciously formed ones) can have functional effects, becoming a part of the context-determining action. It should be stressed that goals are only one form of influence on behaviour: environmental conditions and OS processes also contribute to determine what behaviour will eventuate. When our subsequent behaviour is congruent with ES goals, we think of that behaviour as freely chosen, as compared to the situation when competing impulses sum to produce action that is inconsistent with ES goals, which we experience as an absence of control. We act by creating stories that elicit virtual environments and virtual objects within them (goal objects) that stimulate our OS to act in ways consistent with the story instead of responding to the balance of forces in the real world. However, this only happens

when the emotional impetus on the OS to act in this way is stronger than the impetus coming from the external environment in interaction with internal need states.

The OS operates differently; it is a combination of trait-like response tendencies and variable need states that generate impulses to act in conjunction with conditioned or inherent reactions to external inputs. The apparent goals of the OS are emergent properties of contextual factors interacting with the state of the organism. OS *goals* do not orient behaviour or act as a driver of behaviour; they are merely an ES-generated post hoc description of what happened.

The generation of behaviour

HTM behaviours are behaviours where there is a major divergence between the reactive tendencies of the OS and the relevant goals of the ES. That is, the ES has decided a goal is desirable, but the OS is not sufficiently cued to enact the relevant behaviours in at least some of the situations where it is required. This results in a contest between the ES (what we think we should do) and the OS (what our bodies in context want us to do). The ability to choose *should* over *want* defines self-regulatory capacity, which involves capacity to both maximise the likelihood of making the most adaptive choices, and to implement and sustain the behaviours that result from those choices.

CEOS differs from the Social Cognitive Theory of Bandura [43] and other behaviourally oriented theories, in that it explicitly postulates reciprocal influences within the person (i.e. between OS and ES), as well as between the person and the environment as determinants of behaviour, making behaviour change a shifting function of four broad sets of interacting determinants (rather than Bandura's three) (Figure 1.2). These are:

- (a) the nature of the behaviour change required (the challenge), that is, the specific behaviours to change that are chosen. This choice can range from a discrete behavioural choice such as quitting smoking, to a more complex lifestyle change (e.g. eating a healthy diet);
- (b) the context or the environment (particularly social, but also physical) in which the behaviour is to take place and how it is changing;
- (c) operations of the OS (characteristics of the person, both innate and acquired, such as sensitivity to stimuli and past conditioning); and of
- (d) the ES, via the person's conceptualisation of the behaviour change challenge in relation to what is desirable, something influenced both by his/her analysis of implications of the behaviour and of what they want for themselves (their conceptualisation of themselves as part of their life story).

The other elaboration of this model from Bandura's triangular model is of the specific role of behavioural pre-requisites; that is, tools and other objects in the environment that are consumed or used for some forms of action. Thus, one can't smoke without a cigarette (or other similar product) or eat without food. Tools need

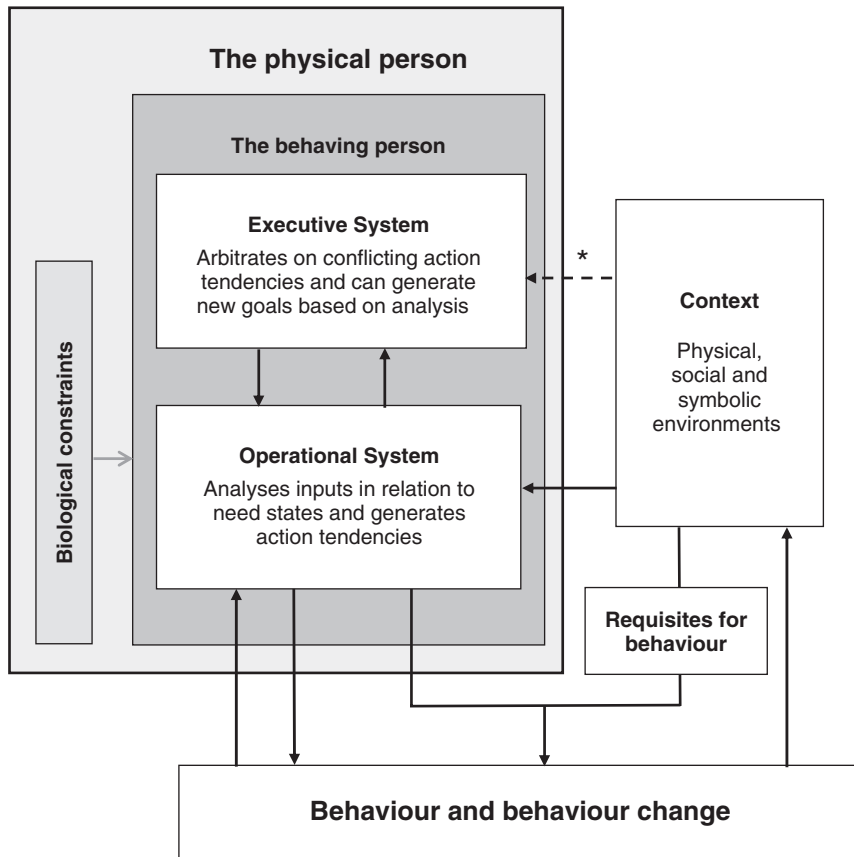


Figure 1.2 A more detailed version of Figure 1.1, which emphasises the impacts of biological constraints and acknowledges the interactive implications of needing or using things in the environment to act with (requisites).

* This link is actually through the OS; it parallels the sensory reactive pathway through the OS, but as it is functionally different. It is depicted this way to highlight the fact that symbolic aspects of the environment (e.g. written or spoken language) only affect the OS once they have been decoded by the ES. NB: This does not apply to physical manifestations of the signals, which influence operational processes directly.

not be necessary, they can just facilitate action, for example, eating utensils can facilitate eating.

The way a person's executive thinks about a problem behaviour, including the compatibility of his/her account with the underlying and changing reality (both environment and OS), is important in determining whether they can change volitionally or not. Other factors include the choices they make and the priority and level of commitment to their chosen goals. These affect the extent to which their script or plan for action correctly identifies the key tasks required for change to occur. To date, most of the theorising for behaviour change has focussed on

an understanding of the influences of the environmental context on behaviour, while the ways the OS responds have been relatively ignored (see Chapter 3). One important contribution of CEOS is to correct this imbalance. In this, it shares similarities with a range of theories that focus on mindfulness and/or are concerned with how we interpret our emotional experiences [50, 78].

The key tasks of behaviour change are to identify desirable changes and to work to implement and maintain them. This involves some mix of modifying the environment to change the pattern of cues towards the desired behaviour, reconditioning the OS to be more supportive of change, reframing thinking to support change and more generally enhancing self-regulatory capacity.

Capacity of the ES

The duopoly between OS and ES is an emergent property of a multi-level control system [3], with the lower referenced to the environment of the moment (the OS). The ES emerges out of the higher levels of this system (with capacities for long-term memory) to represent aspects of its internal functioning and to conceptualise what should be, could be, or was. The ES requires large amounts of OS processing to generate the small number of ideas that it can hold in consciousness at any one time and relate them both to each other and to other inputs from the OS (i.e. relevant perceptions, feelings and action impulses). This is because the ideas the ES needs to manipulate in thought are built up from higher order OS processes, a much more complex task than registering and reacting to what is in the environment. When the OS has a high level of other demands on it, some of this capacity can be diverted to dealing with more immediate priorities, limiting capacity for analysis of what is desirable in the longer term, or what is logically consistent.

Both the OS and ES can adapt and change, albeit in different ways, and both are subject to exhaustion if overused (either too much and/or too long). Processing capacity can also be diverted away to other priorities by mechanisms of attention, which can range from lower level processes sensitive to the relevance of environmental stimuli, or via ES choices. Either or both can result in reduced capacity for processing information relevant to any given task. Capacity limitation in the ES is more likely to be apparent than that of the OS that underpins it, in part because it is supported by the part of the OS that requires the most information-processing capacity. Limits on information processing constrain the capacity of the ES to exercise self-control, increasing the risk of relapse. Maintaining commitment to a goal in the face of changing environmental conditions and associated emotional reactions can be difficult when conditions trigger attentional mechanisms that take up processing capacity. Further, there is no fail-safe mechanism for ensuring the resumption of resistance once diversions have been dealt with. This analysis is consistent with subjective experiences: when distracted from any complex task, it is often difficult to pick up from where you were afterwards, indeed unless re-cued, the train of thought can be forgotten.

The more things there are to attend to, the less executive capacity that gets allocated to any one thing or the less time allocated, both of which will reduce

the capacity to make decisions. Considerations of goals and commitments are particularly vulnerable to being neglected as they usually lack the benefit of being triggered into consciousness directly by operational processes (environmental cues or feelings), instead being reliant on triggers from other executive processes. The reality is that we spend most of our time attending to the priorities that demand our attention. Among other things, this explains why, once a goal for action has been established; efforts at behaviour change tend to be episodic rather than continual. The challenge is to create conditions so that we focus on our goals at appropriate times. This is particularly important for the maintenance of behaviour as relapse is likely unless self-control mechanisms are initiated in those situations where there is a net tendency to resume an unwanted behaviour.

Initiation versus maintenance of behaviour

CEOS postulates that ES processes are primary for the initiation of change (except those solely in response to a changed environment), but the OS plays a much more important role in the maintenance of change, both directly and by influencing ES choices.

After change is initiated, the ES remains important for the maintenance of goals and for self-management. It can both exercise self-control and create conditions to assist in the retraining of the OS to be better prepared to act in goal-congruent ways. Before change, the task is primarily cognitive (ES); to have the person persuade themselves to make the change and choose an appropriate time to start. By contrast, the main task after change is to maintain the new behaviour pattern. This involves actively persevering in the effort, at least until the OS is recalibrated to minimise the likelihood that cues (environmental and/or internal) will trigger a relapse to the previously highly OS cued behaviour. ES processes can change settings (reference points around which it and the OS operates), including thresholds to trigger its engagement (attention) when undesirable action tendencies occur that may require more than OS processes to inhibit. The very contemplation of change can evoke emotional (OS) reactions, and this can act as an additional force to inhibit further consideration of change. OS processes can block consideration of change or act as barriers to immediate action when the idea is considered. This OS reactance needs to be overcome for ES-directed action to occur. The need for the OS to coordinate the generation of behaviour explains why, even though people may want to change when asked and may make frequent decisions to act, they tend to make far fewer attempts to change than might be expected. For example, smokers, even those who are highly motivated to change, make decisions to quit much more often than they follow through and actually initiate quit attempts [71, 79]. They have been unable to provide sufficient impetus to overcome OS reactance.

CEOS also postulates that the level of motivation or net reasons for action that are sufficient for the initiation of action are sufficient to maintain behaviour, indeed the motivational threshold for relapse is lower than for initiation. However, net

motivation fluctuates markedly, largely as a result of OS reactions, and it is this fluctuation that creates the main proximal determinant of relapse along with fluctuations in self-control. Unfortunately, these two processes tend to co-occur, as it is in moments of stress that urges to resume some behaviours are greatest, and the stress also diverts self-control capacity from either resisting the undesirable behaviour or initiating a new behaviour to deal with the source of the problem, thus making relapse more likely.

The relationships between the two systems

CEOS does not conceive of OS actions as distorting the way the ES thinks, unlike some other theories; for example, Prospect theory [56], rather it focusses on the ways the ES needs to act to create a context to get the OS to enact its decisions. The ES has evolved as a mechanism for improving the adaptiveness of OS actions, but can still be unduly influenced by OS processes. However, rationality-based ES processes can also be misled and can lead to inappropriate actions as well. This raises the issue of how the individual decides when to go with what the rational argument concludes is appropriate, when to go with gut feeling, and how to decide between competing arguments or stories.

The ongoing dynamic of the interrelationships between the two systems means that teasing out what leads to the most adaptive outcomes is something that is only ultimately achievable through observations of outcomes. We as a culture have learnt to trust certain ideas, and then if circumstances mean they lose their predictive capacity, to shift to new ideas. However, this process is slow and error ridden. Along with reactions and advice of others, OS reactions are a key element of signalling possible problems in our ES-based analysis. However, this signalling can give the wrong message in cases where the OS is creating impulses towards undesirable responses. While OS reactions can and do sometimes lead us astray, it is important to reiterate that for the most part the OS does a good job.

The ES has the capacity to generate action tendencies or scripts that are designed to achieve goals that are oriented towards the future, while the OS only acts for the moment. This means that the main conflict is often between the contingencies of the moment and the potential of the future. This suggests that approaches to decision making, which focus on the balance between the pros and cons of behaviour, are missing something important. For any given set of conditions, the OS produces a net action tendency towards one behaviour (except in cases of extreme conflict), and, similarly, executive functions can come up with a rational appraisal of the net costs and benefits of options in the long term (outcome expectancies). CEOS postulates that it is the balance between the immediate consequences and the longer term outcome expectancies that is the core of decisional balance. This framing implies that immediate consequences will have some priority over longer term consequences, and explains some of the effects of temporal discounting, along with conceptualisation of the value of outcomes when they are delayed.

Story creation within the ES

CEOS has a focus on conceptualising problems in ways that optimise strategies for change, that is, to increase the likelihood of success and/or reduce the difficulty of the task.

Humans have the capacity to imagine the future and reflect on the past. We organise these ideas and thoughts into stories. Stories are the vehicle for our capacity to transcend our environment in useful ways, including our extraordinary creativity. The roles of stories are elaborated throughout the book, but at this point it is sufficient to say they play roles in providing explanations of what has happened, including justifications for past behaviour, and in evaluating and reflecting on past efforts and their consequences. Also critical here is the capacity to create a ‘change story’, that is a story that provides both a justification for change (an imagined future) and a plan of action as to how it can be achieved. A compelling justification for goal-directed action is important for generating associations necessary to create adequate OS priming for the behaviour to occur, and eventually, to support the conditions that maintain the change. The plan or script for action is critical for spelling out what to do and when to do it.

The stories and goals people come up with can be their own creations, but they are often ones that their culture has encouraged them to adopt. The range of stories within a pluralist society is often greater for HTM behaviours as it tends to include stories justifying inaction as well as those supporting action. Sharing and discussing stories is one means by which they can be refined and validated as useful. Evaluation of the extent to which stories inform about the normativeness of behaviours is also important in influencing decisions about change (see Chapter 4).

Stories vary in their applicability to specific contexts. Because of the ever-changing reality in which people have to operate, stories, particularly old stories, can lose their relevance and thus utility, both as explanations and/or as scripts for change, potentially resulting in inappropriate choices and failure to achieve goals. This means there can be a need to modify stories as circumstances change, but for HTM behaviours those circumstances include resistance to change; so, there are risks that changes might including rationales for inaction or relapse (see Chapter 3).

Biological constraints

The functions hypothesised for the OS and ES must have biological underpinnings. These are beyond the scope of this volume to specify; however, I believe that nothing postulated in the theory is inconsistent with what we know about biology. The main reason for not discussing biological underpinnings is that all behaviour, including volitional behaviour, has biological underpinnings; so, demonstrating a link to biology does not, of itself, say anything about the plasticity of behaviour.

It is assumed, as a starting point, that all human behaviour is potentially malleable, but that the determinants of some behaviours are more strongly physiologically constrained than for others and that the levels of constraint vary

across individuals (due to genetics and/or irreversible past experiences). Thus, the ease of behaviour change varies, and at the extremes, there may be cases where for all practical purposes, physical interventions to change biological processes are either necessary or more efficient than behavioural interventions. It is possible that advances in genetics and cognitive neuroscience will increasingly specify differences between individuals that are innate/acquired, and which are impossible or difficult to change by behavioural means. This variability can include general tendencies to behave (e.g. levels of inhibitory processes) and behaviour-specific constraints. However, until limits on flexibility are established, it remains sensible to assume that forms of change that at least some people are capable of are achievable by all (or most), and to try to identify more effective behavioural strategies to achieve change among those who find it most difficult.

The perspective taken here is to theorise in ways that push the limits for behavioural interventions. Physiological interventions are considered where they shed light on underlying behavioural mechanisms or potentially complement behaviour change strategies. Biological solutions are particularly important in the area of drug addiction, as substitutes for more harmful forms of drugs, or to reduce the experienced pleasures of recreational drugs. Biological interventions are becoming an increasingly part of the solution for obesity, including surgical interventions like lap-band surgery to reduce the size of the stomach, and liposuction. Whether these interventions represent a failure of our attempts at behavioural solutions or necessary interventions to deal with otherwise unmodifiable problems remains an open question.

It is not just behaviours that may be amenable to behavioural interventions, some medical conditions can be reversed behaviourally. For example, eating too much and becoming obese can affect metabolism, resulting in diabetes, which used to be thought to be irreversible. However, lifestyle change in the form of a better and more constrained diet can reverse key features of diabetes [80, 81].

Variability in capacity is not the only biological constraint on behaviour change. Variability in susceptibility to adverse consequences of behaviour is also important, as it is an important potential source of variation in motivation to make changes. For example, there is an increasing evidence that biological factors, both innate and those which can be set or reset in utero or with early experience, can determine whether the body tends to conserve excess energy inputs as fat or to expend them [82], thereby affecting weight gain independent of calorific input. It is also possible, although as far as I know not proved, that behavioural aspects of food seeking and consumption could be similarly influenced by these biological mechanisms. Thus, a famine-programmed person may also be more sensitive to food-related cues; not only being prone to eat more, but also to put on more weight per unit of input. This would help explain why in a culture of excess (for food), some people end up extremely fat while others don't.

However, people need to know if they are at higher risk, something that may require biological indicators being found, if action is to be initiated prior to manifestation of the problem. Biological variability can also influence capacity to self-regulate psychoactive substances. For example, someone whose cognitive

capacities are most disrupted by any given level of a drug will become impaired more quickly and thus have less capacity to regulate their consumption, and thus may be more prone to intoxication, and associated adverse effects.

The variability both in susceptibility to adverse effects and in capacity to change behaviour means that one size fits all solutions are unlikely to work. Where biological factors strongly predispose, there will be greater limits on the capacity of behavioural factors to produce change.

Elaboration of CEOS theory

CEOS theory, through its component parts, is designed to explain moment-to-moment influences on behaviour, and to predict the nature and form of longer term changes. Understanding lies at three levels of organisation: (i) theories of the reactive organism acting in its environment; (ii) theories of how stories, underpinned by language, create a new set of referents for behaviour, and how these compete with OS-generated action tendencies to influence behaviour; and (iii) how actions of individuals and other agents interact to create social norms, and a process of social change that typically occurs over a longer time-scale than change within individuals. The primary focus of this book is on the middle of these three, ES functioning, but with a strong focus on how it interacts with OS functioning. There is less focus on longer term societal change, but there is a focus on the implications of the changing nature of the population who engage in HTM behaviours. See Young *et al.* [83] for an analysis of how the broader, more normative system operates and the role of individuals in working for change.

The central feature of CEOS is the distinction between the OS which is reactive to the environment, and the ES which is built on the OS, but also uses conceptual analysis of what is desirable and feasible to influence behaviour. Key secondary features of CEOS, constructed on the basis of research evidence, are differences between the determinants of the initiation and determinants of the maintenance of behaviour. Further, as a result of the predictability of repeated failures, as the prevalence of the behaviour problem changes, the characteristics of the population engaging in that behaviour must be changing. The rest of this book elaborates on aspects of the theory and its implications.

The next chapter (Chapter 2) spells out characteristics of HTM behaviours, both hard to reduce and hard to sustain, and how they differ from other behaviours and each other. These two complementary forms of HTM behaviours represent the two kinds of discord between operational and executive processes.

Chapter 3 elaborates on the conceptual advantages of the distinction between the OS and ES. It explains how the non-volitional OS works by rapidly processing information from the environment and (more slowly) information on internal states, resulting in the generation of action tendencies, and/or information being sent up to the ES in the form of perceptions, feelings and urges. The OS is the primary determinant of behaviour. Its operations can be modified through conditioning and to a limited extent by some forms of executive inputs. A key insight is that negative affect

drives behaviour, even when non-contingent; however, only contingent positive experiences influence subsequent behaviour via operational processes.

Chapter 3 also explores how the ES works and its various roles and functions. The ES can analyse the implications of the moment in relation to future possibilities, and uses stories to motivate the OS to act appropriately and try to organise behaviour towards conceptually formed goals. It focusses on two aspects of self-regulation: self-control and self-reorganisation (recontextualising). The chapter finishes with a detailed comparison of CEOS and RIM [18], a dual-process theory that shares some common features, but potentially theoretically interesting differences.

Chapter 4 considers the role of the environment, and how and when societal and environmental changes can be used to influence personal change and the limitations of this for HTM behaviour. It also considers the kinds of environmental changes that can be generated by societal forces.

Chapter 5 drills down into the key conceptual aspects of executive functioning. It considers the importance of the way issues are framed, in terms of both what is considered relevant, and within that, the framing of information that influences its interpretation. It highlights the importance of organising ideas in a quasi-hierarchical manner to simplify analysis, and of cognitively simple arguments that avoid negations as these are processed differently by the two systems. It makes a key distinction between goal formation and the development of scripts to enact change, and focusses on what influences the desirability and perceived feasibility of change and how these facts vary from goal formation to script development and enactment. It argues that decisional balance for action is a balance between long-term outcome expectancies and the net experiences of the moment, in the context of the priority for action in relation to other life issues.

Chapter 6 considers the structure of the change process, focussing first on individual attempts to change, then considering how these accumulate over time to change the nature of the population of those who have not yet changed. It separates out the processes of goal formation from the development and implementation of specific attempts, of which there are typically many. Goals only influence behaviour when brought to mind; thus, there is a need for mechanisms to ensure they are cued to occur at appropriate times, especially for HTM behaviours that are not naturally cued. Determinants of behaviour change differ for persuasion, initiation of action and maintenance of change. Determinants are organised around factors, influencing the desirability and feasibility of the behaviour change. Important concepts developed include the importance of the prioritisation of actions, the nature of commitments to act, and the nature of different kinds of evaluation/feedback loops.

Chapter 7 considers strategies for behaviour change: providing better or more timely information for Executive processes; otherwise improving the efficiency of executive functioning, in particular, using implementation intentions; using executive processes and/or external agents to facilitate reorienting operational processes to be less strongly cued towards unwanted behaviours and more strongly cued to desired ones; and changing the environment; so, the pattern of cues is more conducive to desired behaviours.

The final chapter (Chapter 8) brings together considerations for research, including implications for measurement and key researchable differences in CEOS's predictions compared with other theories.

Summary

This chapter introduces CEOS theory, a theory designed to understand why some behaviour patterns are hard to maintain. At the core of CEOS is the idea that the person is best conceptualised as two interrelated systems that jointly, in conjunction with environmental contingencies, determine human behaviour. These two systems are a more basic OS that responds adaptively to the contingencies of the moment (both internal needs and environmental conditions), and an ES that allows volitional actions in response to articulated goals. The theory focusses on how we can use volitional processes to reshape behaviour away from the contingencies of the moment, and as such is a dual-process theory. This framing helps to understand why the determinants of the initiation of behaviour differ from those of maintenance, and why the latter task is so difficult. CEOS is designed to be a theory of self-regulation in the face of difficulty by self-control and/or self-reorganisation.

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