The Human: Basic Psychological Principles

Core Body of Knowledge for the Generalist OHS Professional

Safety Institute of Australia Ltd

Australian OHS Education Accreditation Board

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Disclaimer

The OHS Body of Knowledge for Generalist OHS Professionals has been developed under the auspices of the **Health and Safety Professionals Alliance**

The Technical Panel established by the Health and Safety Professionals Alliance (HaSPA) was responsible for developing the conceptual framework of the OHS Body of Knowledge and for selecting contributing authors and peer-reviewers. The Technical Panel comprised representatives from:

The Safety Institute of Australia supported the development of the OHS Body of Knowledge and will be providing ongoing support for the dissemination of the OHS Body of Knowledge and for the maintenance and further development of the Body of Knowledge through the Australian OHS Education Accreditation Board which is auspiced by the Safety Institute of Australia.

Synopsis of the OHS Body of Knowledge

Background

A defined body of knowledge is required as a basis for professional certification and for accreditation of education programs giving entry to a profession. The lack of such a body of knowledge for OHS professionals was identified in reviews of OHS legislation and OHS education in Australia. After a 2009 scoping study, WorkSafe Victoria provided funding to support a national project to develop and implement a core body of knowledge for generalist OHS professionals in Australia.

Development

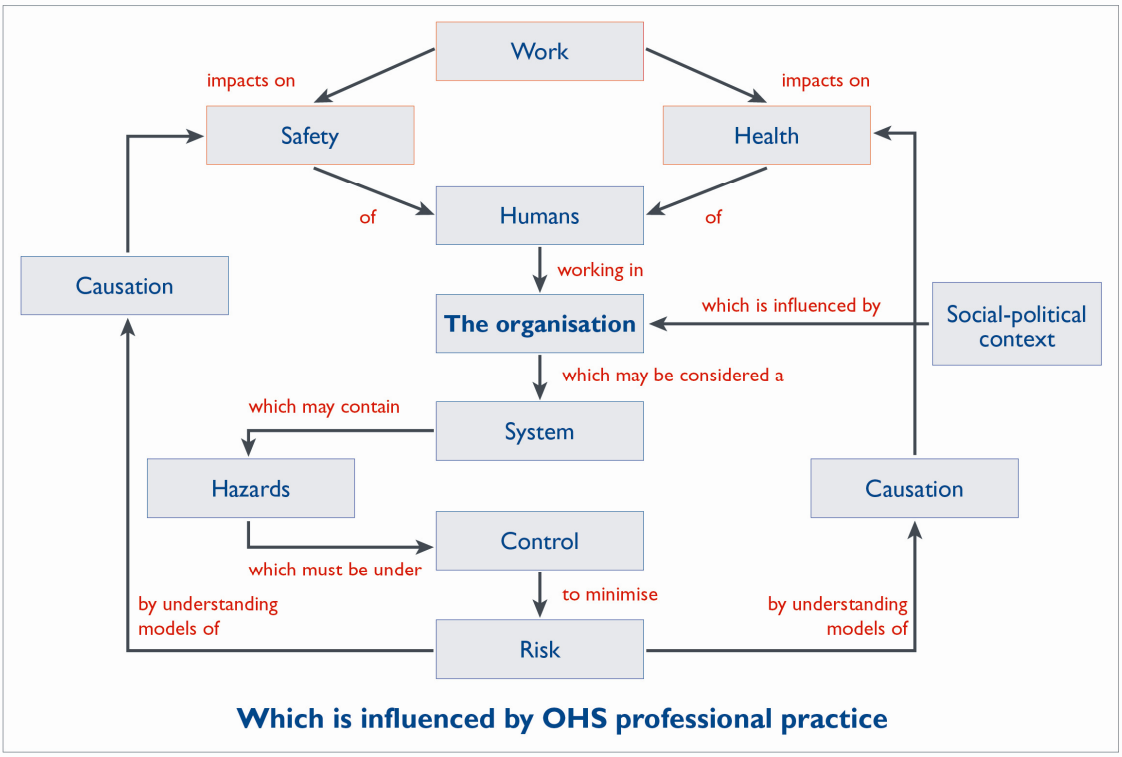
The process of developing and structuring the main content of this document was managed by a Technical Panel with representation from Victorian universities that teach OHS and from the Safety Institute of Australia, which is the main professional body for generalist OHS professionals in Australia. The Panel developed an initial conceptual framework which was then amended in accord with feedback received from OHS tertiary-level educators throughout Australia and the wider OHS profession. Specialist authors were invited to contribute chapters, which were then subjected to peer review and editing. It is anticipated that the resultant OHS Body of Knowledge will in future be regularly amended and updated as people use it and as the evidence base expands.

Conceptual structure

The OHS Body of Knowledge takes a 'conceptual' approach. As concepts are abstract, the OHS professional needs to organise the concepts into a framework in order to solve a problem. The overall framework used to structure the OHS Body of Knowledge is that:

> **Work** impacts on the **safety** and **health** of humans who work in **organisations**. Organisations are influenced by the **socio-political context**. Organisations may be considered a **system** which may contain **hazards** which must be under control to minimise **risk**. This can be achieved by understanding **models causation** for safety and for health which will result in improvement in the safety and health of people at work. The OHS professional applies **professional practice** to influence the organisation to being about this improvement.

This can be represented as:



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Audience

The OHS Body of Knowledge provides a basis for accreditation of OHS professional education programs and certification of individual OHS professionals. It provides guidance for OHS educators in course development, and for OHS professionals and professional bodies in developing continuing professional development activities. Also, OHS regulators, employers and recruiters may find it useful for benchmarking OHS professional practice.

Application

Importantly, the OHS Body of Knowledge is neither a textbook nor a curriculum; rather it describes the key concepts, core theories and related evidence that should be shared by Australian generalist OHS professionals. This knowledge will be gained through a combination of education and experience.

Accessing and using the OHS Body of Knowledge for generalist OHS professionals

The OHS Body of Knowledge is published electronically. Each chapter can be downloaded separately. However users are advised to read the Introduction, which provides background to the information in individual chapters. They should also note the copyright requirements and the disclaimer before using or acting on the information.

The Human: Basic Psychological Principles

Dr Carlo Caponecchia **BA(Psych); PhD (Psychology)**
Lecturer, School of Aviation, University of New South Wales
Email: carloc@unsw.edu.au

Carlo is an academic at the University of New South Wales, and holds a bachelors degree and PhD in Psychology. He specialises in psychological hazards at work, and teaches in the area of workplace safety and risk management. His research comprises human factors issues (fatigue, stress, bullying); risk perception, communication and behaviour; and error classification. Carlo has provided expert opinions and consultancy advice to several industries on safety-related projects, and is involved in training, independent workplace investigations, and organisational development.

Peer reviewer
Bill Pappas BBSc, BA, BEd, DipTeaching, MVocCouns
Organisational Psychologist
National Convenor, Australian Psychological Society, Occupational Health Psychology Interest Group

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Abstract

Work always involves humans. Humans are complex beings and their behaviour and their health is the result of interaction within and between their internal biological, psychological and social systems and their physical and social environment. This chapter outlines elements of psychology relevant to Occupational Health and Safety (OHS) professional practice. Although the discipline is influenced by many different schools of thought, modern psychological practice employs scientific methods. Particularly relevant to OHS practice, are behavioural psychology (the foundation of behaviour-based safety) and cognitive psychology (which highlights the cognitive capacities of workers, and errors that can occur in decision making). Also, this chapter describes the physiological bases of some psychological phenomena to be considered when improving and protecting the health and safety of workers, and provides basic information about personality psychology and mental disorders. Finally, implications for OHS practice are considered using incentive schemes and behaviour-based safety as examples.

Keywords

behaviour, cognition, personality, attributions, psychological disorders, OHS, work

Contents

1 Introduction

This chapter examines basic elements of psychological science that are most relevant for Occupational Health and Safety (OHS) professionals. It is the second in a series of three[1] that examine the human as an individual from biological, psychological and social perspectives to facilitate understanding of the human response to hazards, work and relationships, how work-related injury and illness occur, and how to prevent or mitigate such outcomes.

Psychology is defined as "the scientific study of behaviour and mental processes" (Coon & Mitterer, 2010). Although it comprises many sub-disciplines and theoretical perspectives that vary in methods, scope and area of focus, the modern practice of psychology, in both academic and applied settings, employs scientific rigour in the examination of human behaviour. After brief consideration of the history of modern psychology, the chapter presents some basic psychobiology, which demonstrates the link between foundation science, and human biology and behaviour. It then addresses elements of behavioural, cognitive and personality psychology, and mental disorders, and concludes by considering some ways in which knowledge of human behaviour can inform OHS professional practice.[2]

1.1 Distinguishing between psychology and psychiatry

Clarification of the difference between psychology and psychiatry is warranted because people often confuse these professions with one another. The Australian Psychological Society (APS, 2011a) explains that although psychologists and psychiatrists often work together in mental health settings, a psychiatrist has a medical degree as well as specialisation in the diagnosis and treatment of mental illness, while psychologists study undergraduate (and often postgraduate) psychology.

> Psychiatrists treat the effects of emotional disturbances on the body and the effects of physical conditions on the mind…Psychologists assist people with everyday problems such as stress and relationship difficulties, and some specialise in treating people with a mental illness. They help people to develop the skills needed to function better and to prevent ongoing problems. (APS, 2011a)

Clinical psychologists and counselling psychologists treat clients with mental illnesses or other emotional problems. As psychologists do not have medical degrees, they cannot prescribe medications. Not all psychologists focus strictly on the diagnosis and treatment of mental health conditions; many specialise in other areas of practice (e.g. health psychology, sports and performance psychology, educational psychology) and work in various settings (e.g. public health, corrections services, health promotion, academia).

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[1] Along with *OHS BoK* The Human: As a Biological System, and *OHS BoK* The Human: Principles of Social Interaction

[2] Some other psychological issues relevant to OHS are outlined in *BoK* The Human: As Social Being.

Health psychology – now endorsed by the Australian Health Practitioner Regulation Agency (AHPRA, 2010) as a specialist field of psychology – is the foundation of occupational health psychology, which has made a great contribution to our understanding of psychological injury and related issues in the workplace.

2 Historical development of modern psychology

Examination of the ways in which people behave, and why they do so, has occurred since ancient civilisation. Modern psychology has its conceptual roots in philosophy and 19th century physiology (Cherry, 2010). Its development was influenced by work undertaken in different parts of the world, representative of different values and perspectives. In 1879 in Leipzig, Wilhelm Wundt set up the first psychology laboratory, where he examined people's reaction time to stimuli, studying small mental processes in order to understand more complex ones. Understanding the *structure* of the mind via 'introspection' was a goal of Wundt and his contemporaries. Rejecting structuralism, William James, whose *Principles of Psychology* (1890) has been hailed as the genesis of modern psychology, applied introspective methods to determining the *function* of the mind (Powell, Symbaluk and Honey, 2009). While functionalism and structuralism were superseded by other schools of thought, both made significant contributions to the discipline of psychology (Cherry, 2010; Francher, 2008).

Sigmund Freud (1856–1939) is probably the most well-known figure in the history of psychology. He was a physician who developed what became known as his psychoanalytic theory of the unconscious mind. While there are many interesting aspects to Freudian theory, it was largely discredited by subsequent, more objective developments in psychology. Although some aspects of Freud's *psychoanalysis* – which involved talking about dreams and other experiences to uncover frustrations between the unconscious and conscious minds – have survived (Cherry, 2010), modern psychoanalysis is quite different from Freud's conception, and is no longer considered the dominant treatment option (see, for example, Webster, 1996).

In the early 20th century, researchers such as John Watson considered the behaviour of all organisms, not just humans, and psychological research with animals began (see, for example, Buckley, 1989). *Behaviourism* placed observable behaviour at the forefront of psychological research, and influenced other aspects of psychology such as psychobiology (or behavioural neuroscience). Although behaviourism remained influential, researchers began to infer thoughts, memories and other mental processes from observable behaviour; this was termed the "cognitive revolution in psychology" of the 1960s and 1970s (see, for example, Baars, 1986).

Recognition of the benefits to be gained from applying psychology to the workplace can be traced to the early 1900s. In 1913, Hugo Münster identified a need for organisations:

> …to appoint professionally trained psychologists who will devote their services to the psychological problems of the special industrial plant…It is obvious that the professional consulting psychologist would satisfy these needs most directly, and if such a new group of engineers were to enter into industrial life, very soon a further specialization might be expected. Some of these psychological engineers would devote themselves to…problems of fatigue, efficiency, and recreation; [others] the psychological demands for the arrangement of the machines; and every day would give rise to new divisions. (as cited in Leka & Houdmont, 2010, p. 13)

Today, occupational health psychology (OHP) is a growing and evolving field. The Australian Psychological Society has an Occupational Health Psychology Interest Group (APS, 2011b) with more than 120 members. According to Leka and Houdmont (2010, p. 8):

> OHP [Occupational Health Psychology] can be defined simply as 'the contribution of applied psychology to occupational health'. This 'interface' definition, adhered to in Europe, recognizes that occupational health is a multidisciplinary area and that OHP practitioners offer a focused specialization that they may usefully apply within multidisciplinary teams. The North American perspective on OHP is in large part consistent with the European approach, but differs in that it encompasses psychological perspectives alongside those from other occupational sciences.

3 Psychobiology

Sometimes when a phenomenon is described as 'psychological', the origin of such phenomena is forgotten or misconstrued. In OHS psychological hazards are starting to be recognised as being similar to 'physical' hazards in terms of importance. Though psychological phenomena are not always tangible, they are physiologically mediated through the psychobiological interactions between systems in the body, and their consequent effects on behaviour. Psychobiology is defined as "the study of the biology of the psyche, including the anatomy, physiology, and pathology of the mind" (Thomas, 1985, p. 1406). The purpose of outlining some basic issues in psychobiology is to highlight that psychological phenomena have physiological bases, and the potential for physiological (health) consequences.

3.1 Structure and function of the brain[3]

The brain and spinal cord comprise the *central nervous system*, while the nerves that link the brain and spinal cord to muscles and glands comprise the *peripheral nervous system*. The peripheral nervous system is divided into the *somatic nervous system*, which refers to those nerves that act on skeletal muscles, and the *autonomic nervous system*, which acts on visceral muscles and glands. The autonomic system is further subdivided into the *sympathetic nervous system*, which mobilises the body for response to threat (see section 3.2), and the *parasympathetic nervous system*, which has essentially the opposite effect in that it helps to calm the body after its emergency response (see, for example, Cherry, 2010).

[3] See also *BoK* Foundation Science and *BoK* The Human: As a Biological System

The brain is divided into four lobes, each of which has particular primary functions (Figure 1).

- Occipital lobe – primarily responsible for receiving and processing visual stimuli
- Parietal lobe – primarily responsible for tactile and sensory processing, such as touch, pressure and pain; includes the somatosensory area near the central fissure
- Frontal lobe – primarily responsible for reasoning and higher-level cognition; includes the primary motor area near the central fissure, which receives input from other areas and coordinates movement
- Temporal lobe – primarily responsible for receiving and processing auditory stimuli.

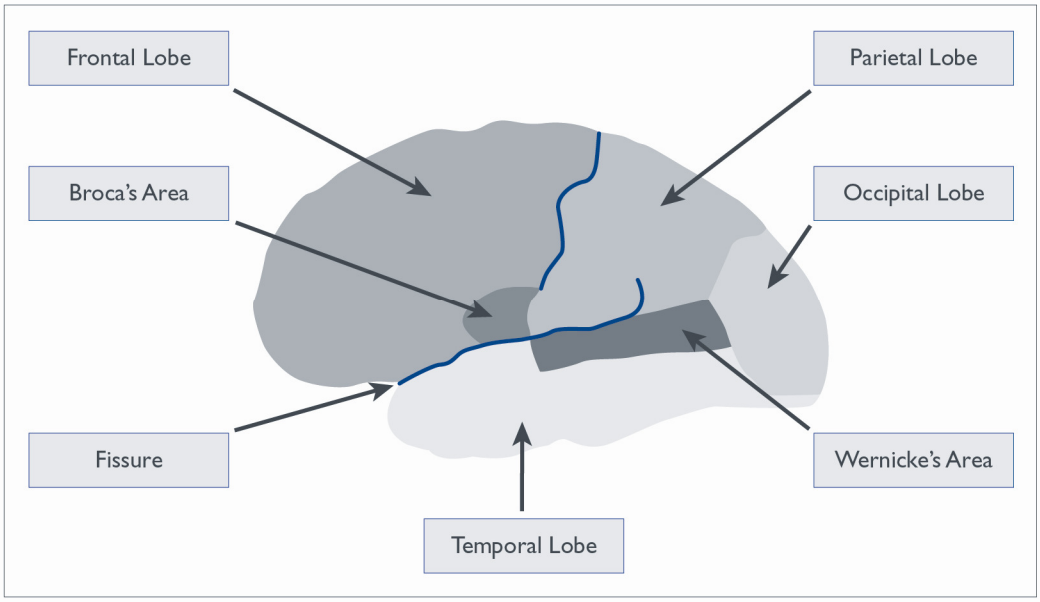

Figure 1: The human brain

The left and right hemispheres of the brain are connected by the corpus callosum; the left hemisphere controls the right side of the body, and the right hemisphere controls the left side of the body. Speech and language processing are most commonly associated with the left hemisphere, which includes Broca's area that is important for speech production, and Wernicke's area that is important for language comprehension. Generally, the right hemisphere is responsible for non-verbal, visuospatial processing. These distinctions were discovered through 'split brain' studies conducted on people who had their corpus callosum severed as a last-resort treatment for epilepsy, or had suffered strokes or damage to particular brain areas (see, for example, Boeree, 2003).

Several subcortical structures have important roles in memory and emotion (see, for example, Swenson, 2006). These, collectively known as the *limbic system*, include the hippocampus, which has a major role in the formation of memories, and the amygdala, which has a major role in emotional reactions. Connected with the limbic system is the hypothalamus, which is involved in the regulation of basic biological needs such as hunger and thirst, and has important roles in the autonomic nervous system and in linking the brain to the endocrine system.

Psychological stimuli have complex interactions with systems of the body; for example, the experience of a stressor (depending on its nature, duration and factors specific to the individual) can have lasting effects on the cardiovascular and immune systems.

3.2 Some physiological consequences of stress

An important example of psychobiological interactions relevant to OHS is the stress response, which also indicates how neural and endocrinological systems work together. The physiological aspects of stress are activation of the hypothalamo-pituitary-adrenal (HPA) axis (Figure 2) and activation of the sympathetic nervous system (SNS). The SNS releases adrenaline, and is activated in situations where an organism may have to 'fight or (take) flight.' The heart rate and blood pressure are elevated, blood goes to the brain and muscles, while bodily functions that are non-essential for a fight or flight response are inhibited (e.g. digestion). Briefly, the HPA axis is involved in the release of cortisol, a glucocorticoid, which is essential for energy regulation (among several other functions). The hypothalamus releases corticotropin releasing factor (CRF), which stimulates the anterior pituitary to release adrenocoticotropin releasing factor (ACTRF), which in turn stimulates the release of cortisol from the adrenal medulla on top of the kidneys.

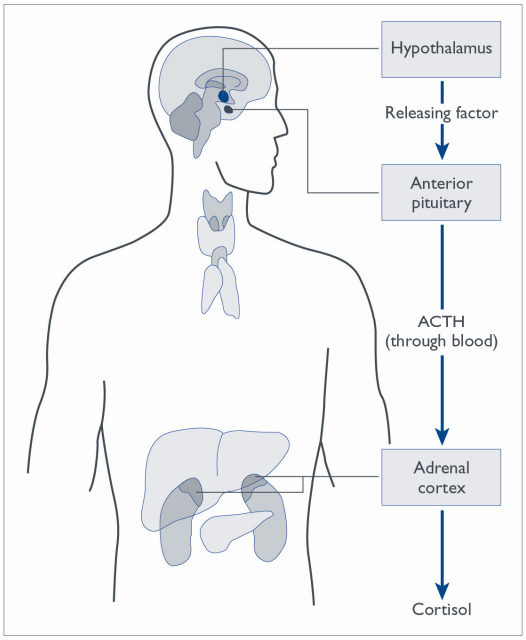

Figure 2: Hypothalamo-pituitary-adrenal axis

Stress has been shown to have numerous health impacts. Because of its effects on the HPA axis and the resulting release of glucocorticoids, which can have immunosuppressive properties, if stress occurs too frequently or too severely it can have immunosuppressive effects (see, for example, Sapolsky, Romero & Munck, 2000). Several studies of students during exam periods, and of carers for people with Alzheimer's disease or other debilitative disorders, have consistently shown reduced immunity function as a result of stress (e.g. Kiecolt-Glaser & Glaser, 1994; Glaser, Pearl, Kiecolt-Glaser & Malarkey, 1994). Stress-induced immune-suppression has gone from an extremely controversial idea (because scientists once thought that the immune system was completely autonomous and not linked with the brain) to being generally accepted, and has resulted in the subdiscipline of psychoneuroimmunology (see, for example, Ader, Felton & Cohen, 2001).

Stress can influence cardiovascular disease either by effects on lifestyle behaviours (decreased exercise, poor diet, etc.) or by SNS effects (see, for example, Black & Garbutt, 2002). Several studies have demonstrated the relationship between high stress and cardiovascular problems, using magnitude of current stress responses to predict future cardiovascular problems (such as hypertension and atherosclerosis) (see, for example, Matthews, Woodall & Allen, 1993), and by examining the relationship between job stress and coronary heart disease incidence and mortality (see, for example, Theorell and Karasek, 1996). The Whitehall studies (UCL, 2011) were important in the collection of prospective data on the links between workplace stress and cardiovascular disease, while controlling for other risk factors (smoking, poor diet, lack of exercise). Meta-analyses of prospective studies examining the link between stress and cardiovascular

disease have shown that workers exposed to higher levels of work stressors show an increased incidence of cardiovascular disease compared to those exposed to fewer stressors (Kivimäki et al., 2002).

4 Behavioural psychology

Several aspects of behavioural psychology have direct applications in OHS interventions. Behavioural psychology is sometimes referred to as 'the psychology of learning' or 'learning and motivation' (see, for example, Schwartz and Robbins, 1995).

Classical conditioning involves the pairing of a stimulus that produces a response under any circumstances (e.g. food produces a salivary response) with a neutral stimulus (e.g. a sound tone) such that, over time, the neutral stimulus elicits the response when presented alone. This kind of learning is most famously described with reference to Pavlov's dogs (see, for example, Schwartz & Robbins, 1995). Classical conditioning can be used with humans to form associations that control behaviour (e.g. pairing smoking with the ingestion of a substance that makes one feel sick, so that the cues associated with smoking make a person feel sick even when the substance is not ingested, and thus less inclined to smoke).

Operant conditioning concerns how organisms learn about the connection between situations, behaviours and consequences. In 1898, Edward Thorndike conducted learning experiments with cats. Hungry cats were placed in a 'puzzle box' where they made various responses (pacing, meowing, etc.) until they found that pressing a lever would liberate them from the box and allow them access to the food outside. From these experiments, Thorndike developed his Law of Effect, which states that:

> Of several responses made to the same situation, those which are closely accompanied or closely followed by satisfaction to the animal will, other things being equal, be more firmly connected with the situation, so that, when it recurs, [the behaviours] will be more likely to recur (Thorndike, 1911, p.244).

In other words, behaviour can be controlled by its consequences. A stimulus leads to a response, which is reinforced: Stimulus → Response → Reinforcement. The stimulus for Thorndike's cats was the box. The response was the action of pressing the lever and the reinforcement was the food. B. F. Skinner (1938) applied the term 'operant conditioning' to this form of behaviour modification after extending the concept with rats. In the now iconic 'Skinner box,' rats learned to press a lever when a stimulus (e.g. a light or tone) was present. The lever press resulted in the delivery of food (the reinforcer). Applying this to behaviour-based safety, the stimulus-response-reinforcer connection parallels the antecedent–behaviour-consequences (ABC) model that is used to analyse and change behaviours (see section 8.2.1).

4.1 Types of reinforcement

Different types of reinforcement[4] have different effects on the target behaviour (Table 1).

Table 1: Types of reinforcement

	Type of reinforcer	
Response	Positive (Appetitive/Nice)	Negative (Aversive/Nasty)
Produces the reinforcer	Positive reinforcement (Response increases)	Punishment (Response decreases)
Eliminates/prevents or removes the reinforcer	Omission training (Response decreases)	Negative reinforcement (Response increases)

It is easy to think of examples of positive reinforcement and punishment, for example:

- A child is well behaved while at the shopping mall and receives a chocolate bar: *positive reinforcement*
- A child is not well behaved and gets a 'time out' at home: *punishment*.

Omission training and negative reinforcement are a little more difficult to conceptualise; for example:

- Someone who is scared of spiders sprays their home with insect spray (whether it is effective or not); not seeing spiders in the house is *negative reinforcement* of that behaviour, because it is connected with the removal of an aversive event.
- When children are fighting in the back seat of the car their father tells them that every time they fight he will throw a lolly out the window; this is *omission training*, because the behaviour results in the removal of a desirable event.

The different types of reinforcement are readily applicable to adults in workplace situations (see section 8).

The behavioural perspective has been, and still is, incredibly influential in many domains, including education and health care. However, there are several problems with behaviourism when taken to its full extent. The deterministic attribution of a person's behaviour to their environment raises questions about the influences of mental processes and the place of personal responsibility in decision making. Nevertheless, the principles of behavioural psychology relating to how behaviours are learned and reinforced are

[4] Note behavioural consequences are still called 'reinforcers' even when they result in the decreased frequency of a behaviour.

effective in treating some disorders, explaining behavioural connections, and increasing or decreasing the likelihood of particular behaviours.

4.2 Learned helplessness

Another paradigm with roots in behavioural psychology – *learned helplessness* – is relevant to stress, control and depression. In 1967, Seligman and colleagues published the results of experiments which revealed that dogs exposed to inescapable electric shocks gave up trying to evade the shocks and passively succumbed to them (Mikulincer, 1994). One group of dogs was exposed to shocks that they were able to control or escape (i.e. by jumping over a barrier they could turn the shock off), while the other group could not control or escape the shock (i.e. jumping over the barrier did not stop the shock). Animals in the latter group later showed a pattern of cognitive, motivational and emotional deficits, where they simply laid down and passively accepted the shocks, which was termed 'helplessness'.

These experiments highlighted the importance of the controllability of a stimulus to subsequent behaviour, and resulted in a learned helplessness theory of human depression that proposed that once people perceive helplessness (i.e. they feel they cannot control particular negative outcomes), they attribute it to a cause that "can be stable or unstable, global or specific, and internal or external" (Abramson, Seligman & Teasdale, 1978, p. 49).[5]

5 Cognitive psychology

Cognitive psychology developed from the limitations of behaviourism in accounting for some human behaviours/abilities (e.g. the development of language from such a young age), and from advances in information technology and computer modeling. Although some behaviourists, such as Skinner, did not think that unobservable phenomena should be the focus of the science of psychology, the investigation of how humans process and store information has become a dominant field in psychological research. It is important to note that behavioural learning and cognition are linked (e.g. learning involves memory), and the dominant treatment method for psychological disorders is in fact a combination of behavioural and cognitive perspectives and techniques.

Cognitive psychology is relevant to OHS in terms of how cognitive processes such as memory, attention and decision making can affect work performance and safety, including human interaction with complex systems and machines. Many models have been developed to explain the correlation between cognitive factors and human performance; some of these are addressed below.

[5] For a discussion on 'control' see *OHS BoK*: Psychosocial hazards and Occupational Stress

5.1 Cognitive architecture and information-processing models

As defined by Howes and Young (1997), a cognitive architecture "…embodies a scientific hypothesis about those aspects of human cognition which are relatively constant over time and relatively independent of task." Although there are no perfect models of mental function, the 1992 Wickens model, which evolved from Broadbent's 1958 model of information processing, is an instructive summary (Matthews, Davies, Westerman and Stammers, 2000). In the Wickens information-processing model (Figure 3), sensory information is received by the various sensory mechanisms, and basic perceptual properties are preserved for a short time in the short-term sensory store (STSS). From the STSS, information passes through perception and decision-making stages, which interact with the memory system. A response is selected and executed, and there is feedback from this response to environmental stimuli (Matthews et al., 2000).

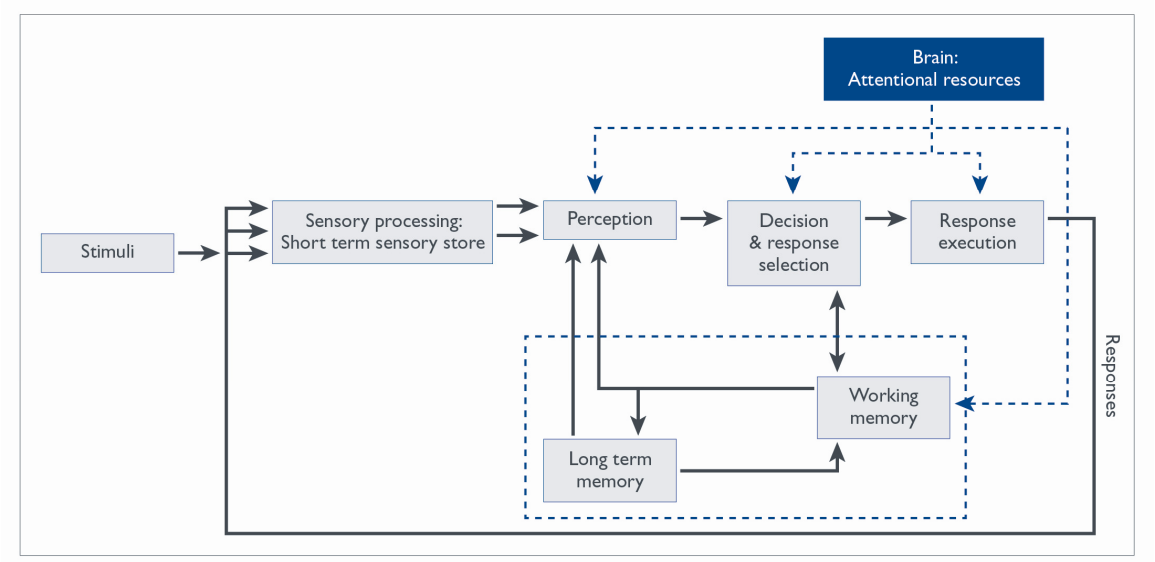

Figure 3: The Wickens model of the general structure of information processing (modified from Matthews et al., 2000)

5.2 Models of memory

Since 1949, when Hebb distinguished between short- and long-term memory, psychologists have been fascinated by the capacity of these memory types and the relationship between them. The popular conception of the limitations of short-term memory was stimulated by Miller's (1956) "magical number seven;" Miller noted that, generally, people can hold "seven plus or minus two" chunks of information in short-term memory before they are displaced by new information (Dehn, 2008). From the many models of memory proposed over the past half-century, those discussed below have enduring relevance.

Building on Broadbent's information-processing model, Atkinson and Shiffrin's (1968) modal memory model described three main components of memory – the sensory register, the short-term store (the 'working memory') and the long-term store:

> Incoming sensory information first enters the sensory register, where it resides for a very brief period of time, then decays and is lost. The…working memory…receives selected inputs from the sensory register and also from the long-term store. Information in the short-term store decays completely and is lost within a period of about 30 seconds, but a control process called rehearsal [e.g. repeating digits of a phone number] can maintain a limited amount of information in this store as long as the subject desires. The long-term store is a fairly permanent depository for information, which is transferred from the short-term store. (Atkinson & Shiffrin, 1968, pp. 14–15)

Though influential, the modal model was found to be overly simplistic with insufficient emphasis on memory processes (Dehn, 2008). In 1972, Craik and Lockhart's 'level of processing' model proposed that 'deeper' encoding of information involved greater semantic analysis and resulted in longer retention. For example, when considering processing of words, structural processing would involve focusing on the physical features of the stimulus, such as whether words were presented in upper or lower case, the number of letters. Higher level phonemic which focuses on what the word sounds like. Semantic processing, which focuses on what the word means and represents, is a deeper level of processing again.

In 1974, Baddeley and Hitch defined working memory as "a system for the temporary holding and manipulation of information during the performance of a range of cognitive tasks such as comprehension, learning, and reasoning" (Baddeley, 1986, p. 34). They proposed a model of working memory that comprised a phonological loop (e.g. repeating digits of a phone number), a visuospatial sketchpad that allowed for the temporary storage and manipulation of visual information; and a central executive that controlled the other components and limited the amount of information people can juggle while making a decision (Dehn, 2008; Goldstein, 2007).

In the 1980s, Tulving asserted that the major long-term memory categories of *episodic memory* (for dated recollections, e.g. where I was when I heard that Princess Diana had died) and *semantic memory* (for general knowledge) were subsystems of the *declarative memory* ('knowing what') system that deals with factual information, while the *procedural memory* ('knowing how') deals with memories for skills and actions (e.g. how to ride a bike) (see, for example, Dehn, 2008; Weiten, 2008.).

5.3 Cognitive biases in decision making and causal attribution

In terms of OHS practice, several cognitive biases that affect problem solving and decision making are particularly relevant to people's perceptions of risk; therefore, these

need to be considered when communicating about risk.[6] People tend to use heuristics, or rules of thumb, when they make decisions in conditions of uncertainty. While acknowledging the general utility of heuristics, Tversky and Kahneman (1974), drew attention to the tendency for their use to result in judgment bias. They described three heuristics commonly employed by people assessing the probability of an uncertain event or the value of an uncertain quantity:

> (i) *representativeness*, which is usually employed when people are asked to judge the probability that an object or event A belongs to class or process B [e.g. stereotyping]
> (ii) *availability* of instances or scenarios, which is often employed when people are asked to assess the frequency of a class or the plausibility of a particular development [e.g. assessing the risk of heart attack by recalling incidences among one's acquaintances]
> (iii) *adjustment from an anchor,* which is usually employed in numerical prediction when a relevant value is available [the tendency is for people to start with an initial guess (or 'anchor') and adjust their view from there; the result is often wrong due to an incorrect initial anchor and typically insufficient adjustment] (Tversky & Kahneman, 1974).

Other issues relating to the interpretation of probabilities or risks include:

- *Problems interpreting low probabilities:* Research has found that people often interpret low probabilities as representing zero (Kahneman & Tversky, 1979); presenting information in a different manner (e.g. as a relative risk rather than a probability estimate) can reduce decision biases that result from probability interpretations (Stone, Yates & Parker, 1994; Caponecchia, 2009)
- *Different representations of probability terms:* Words used to express probability and risk (e.g. 'likely,' 'highly likely') are not always interpreted in the same way or as consistently as may be expected; studies have found that a limited range of probability values (numbers) are associated with a much wider range of terms (Budescu, Weinberg & Wallsten, 1988; Sutherland et al., 1991)
- *Biases in relative risk perception:* Optimism bias is the tendency for people to think that bad things are less likely to happen to them than to others (Weinstein & Klien, 1996); it has been shown to occur in several domains, including health outcomes, natural disasters and OHS (Caponecchia, 2010; Caponecchia & Shiels, 2011)
- *Hindsight bias:* the tendency for people to say 'I knew it all along' (Fischoff, 1975); people change their earlier risk estimates to fit the information they currently have (e.g. after the occurrence of an adverse event) or downplay the significance or nature of earlier risk judgments (see Breakwell, 2007).

Also, many types of bias affect how people assign causation to negative events, some of which have self-protective functions. Among these are:

[6] See *OHS BoK* Risk

- *Fundamental attribution error:* the tendency to overemphasise the importance of internal causes, as opposed to external causes when making judgments about the behaviour of others (Jones & Harris, 1967); for example, a workplace accident could be incorrectly attributed to an employee's behaviour or lack of attention to the rules, rather than to poor quality equipment or procedure
- *Just-world hypothesis* (Lerner & Simmons, 1966): the tendency for people to base causal attributions on the belief that the world is a just and fair place; hence, the suffering of a victim is rationalised in terms of the person having behaved in a way that made them deserve the injustice
- *Interpreting correlation as causation:* the tendency to think that when two events occur together one caused the other; this ignores the possibility that other variables may be implicated, or that there may be no causal relation between the two events.

6 Personality psychology

There are a variety of approaches to personality psychology, many of which have proved controversial. Some important theoretical perspectives that have contributed to our understandings of individual differences are briefly outlined below.

Allport's (1937, p. 48) definition of personality – "the dynamic organisation within the individual of those psychophysical systems that determine his [*sic*] characteristic behaviour and thought" – is recognised as among the most influential approaches (Capitanio, Mendoza and Bentson, 2004; Kobasa, 1990). Allport clarified key concepts of this definition, indicating that 'dynamic organisation' allows for the constant evolution and self-regulation of personality, 'psychophysical' denotes the neural basis of personality, rather than it just being a 'mental' attribute, and the use of the term 'determine' conveys how personality is thought to initiate specific acts within an individual rather than *be* those behaviours. This contrasts with common informal definitions of personality (which probably developed as a 'shorthand' in the absence of clear understanding of the concept), where personality is stated to *be* the individual's characteristic behaviours and thoughts. For Allport, the *trait* – "a neuropsychic structure having the capacity to render many stimuli functionally equivalent, and to initiate and guide equivalent (meaningfully consistent) forms of adaptive and expressive behaviour" (as cited in Carducci, 2009) – is the basic unit of personality study. His hierarchic model of cardinal (i.e. most dominant), central and secondary traits has been useful for integrating many of the personality variables studied in relation to health, and perhaps in accounting for some of the discrepancies; for example, two individuals who score similarly on trait X, but have different health outcomes, may differ in the relative dominance of that trait in their personality (Kobasa, 1990).

A *trait* approach to personality "requires that (1) individuals can be described in terms of their levels on valid and enduring dispositions, and (2) individual differences in these dispositions can predict a substantial proportion of the variance in behaviour" (Matthews, Deary & Whiteman, 2003). The existence of another view – that human behaviour is more dependent on *situation* (see Mischel, 1973) – resulted in the evolution of the currently favoured *interactionist* approach which views personality as an interaction between an individual's characteristic behaviours and the situations they experience (Matthews et al., 2003).

The most generally accepted modern model of personality is the five-factor model (Costa & McCrae, 1992). Characteristics of the five personality dimensions – which "do not represent a particular theoretical perspective but were derived from analyses of the natural-language terms people use to describe themselves and others" (John & Srivastava, 1999, p. 103) – are outlined in Table 2.

Table 2: The Big Five personality dimensions (adapted from John & Srivastava, 1999)

Personality Dimension	Characteristics
Openness to experience	"Describes the breadth, depth, originality, and complexity of an individual's *mental and experiential life*;" people who score highly on openness tend have a wide range of interests, and to be imaginative, insightful and curious
Conscientiousness	A "*socially prescribed impulse control* that facilitates task- and goal-directed behavior, such as thinking before acting, delaying gratification, following norms and rules, and planning, organizing and prioritizing tasks;" people who score highly on conscientiousness tend to be well organised, thorough, efficient and dependable
Extraversion	"An *energetic approach* to the social and material world…includes traits such as sociability, activity, assertiveness and positive emotionality;" people who score highly on extraversion tend to be energetic, outgoing and outspoken
Agreeableness	"A *prosocial and communal orientation* toward others…includes traits such as altruism, tender-mindedness, trust and modesty", people who score highly on agreeableness tend to be sympathetic, affectionate, generous and warm
Neuroticism	"Contrasts emotional stability and even-temperedness with *negative emotionality*, such as feeling anxious, nervous, sad and tense"

Caution should be exercised in applying personality factors, due to issues of context dependence and task dependence. It has been demonstrated that how a person scores on a particular personality dimension will be influenced to some extent by the nature of the situation (e.g. how stressful it is) and the nature of the task (e.g. if it requires

conscientious effort to be completed accurately/on time, etc.). Also, the trait-state distinction is relevant: while traits are relatively enduring, states (e.g. moods) are transitory, which is particularly relevant in the context of anxiety (see Matthews et al. 2003).

6.1 Personality testing

Personality profiling is often used for job-selection purposes, but the supporting evidence it is not always conclusive, given the range of tests and methods used. Some 'personality tests' are still popular, despite being based on theories that are no longer accepted in mainstream psychology (e.g. the Myers Briggs Type Inventory is based on Jungian theory, which is part of the psychodynamic tradition). Low correlations observed between personality inventories and work performance may be due to several factors, including:

- The work performance data used as a basis for personality-score comparisons are not always reliable (e.g. supervisors' ratings of performance)
- Studies of personality and work performance are sometimes performed without a theoretical base (e.g. where there is no preordained reason to think that the personality variable in question would have a relationship to the measured performance variable; i.e. a 'fishing trip') (Matthews et al. 2003).

Caution should be exercised when using personality measures for selection or other workplace purposes. Often it is advisable for independent specialist advice to be sought from a psychologist.

6.2 Accident-prone personality

The central idea in the concept of the 'accident-prone personality' are that there are people who have more injuries than others and that this stems from some enduring individual difference. This was a popular idea from the 1920s to around the 1960s. It has since been found that the group of people experiencing the most accidents were at best a shifting group, and that accident "proneness" was transient (see Burnham, 2009). Although it was suggested that "the accident-prone personality can be described variously as aggressive, hostile, or overactive,…no permanent or stable personality trait of the accident-prone person can be identified" (McKenna, 2000, p. 57). The discipline of ergonomics led the change from trying to fit the worker to the job (eg. finding non accident prone people to work machines and complete tasks), to fitting the task to the worker (eg. by design of equipment, processes and procedures to complement the ways humans perceive events, make decisions, and behave).

In general, it is now widely accepted that the interaction between an individual's behaviour (which may be based on personality, attitude, learning, etc.), their work environment and the features of the task they are performing should be the focus when determining how to improve safety performance. Nonetheless, some safety interventions still focus on humans as the only causative mechanism in accidents. These approaches should be treated with caution.

7 Mental disorders

There are many different theories about the development and expression of the various psychiatric illnesses and psychological disorders, including the relative contribution of genetics, childhood experiences, learning, etc. The degree to which workplace factors contribute to a particular disorder is debated in compensation claims/cases. The relative contributions of work and non-work-related factors need to be considered using whatever evidence is available. An OHS professional should be aware of the categories of psychiatric illness, defined by the American Psychiatric Association (APA, 2000), which can impact the psychological wellbeing of workers. These include:

- Delirium, dementia, amnesic and other cognitive disorders
- Mental disorders due to a general medical condition
- Substance-related disorders
- Schizophrenia and other psychotic disorders
- Mood disorders
- Anxiety disorders
- Somatoform disorders
- Factitious disorders
- Dissociative disorders
- Sexual and gender identity disorders
- Eating disorders
- Sleep disorders
- Impulse-control disorders
- Adjustment disorders
- Personality disorders (APA, 2000)

While any type of psychiatric illness can manifest in psychological disorder, those most relevant to the work environment are *mood* and *anxiety* disorders. Mood disorders include depressive disorders and bipolar disorders, the latter being characterised by alternating periods of depression and mania. Signs and symptoms of depression include:

- moodiness that is out of character
- increased irritability and frustration
- finding it hard to take minor personal criticisms

- spending less time with friends and family
- loss of interest in food, sex, exercise or other pleasurable activities
- being awake throughout the night
- increased alcohol and drug use
- staying home from work or school
- increased physical health complaints like fatigue or pain
- being reckless or taking unnecessary risks (e.g. driving fast or dangerously)
- slowing down of thoughts and actions (Beyond Blue, 2006).

According to the APA (2000), anxiety disorders include:

- *Agoraphobia*: anxiety about, or avoidance of, places or situations from which escape might be difficult (or embarrassing) or in which help may not be available in the event of having a panic attack or panic-like symptoms
- *Specific phobia*: clinically significant anxiety provoked by exposure to a specific feared object or situation
- *Social phobia*: clinically significant anxiety provoked by exposure to certain types of social or performance situations (eg. fear of eating in public, speaking in public)
- *Post traumatic stress disorder*: characterised by the re-experiencing of an extremely traumatic event accompanied by symptoms of increased arousal and avoidance of stimuli associated with the traumatic event
- *Panic attack*: sudden onset of intense apprehension, fearfulness, or terror, often associated with feelings of impending doom. Usually accompanied by symptoms such as shortness of breath, palpitations, chest pain or discomfort, choking or smothering sensations, and fear of 'going crazy' or losing control
- *Obsessive-compulsive disorder*: characterized by obsessions (which cause marked anxiety or distress) and/or by compulsions (which serve to neutralize anxiety)
- *Acute stress disorder*: characterized by symptoms similar to Posttraumatic Stress Disorder that occur immediately in the aftermath of an extremely traumatic event
- *Generalized anxiety disorder*: characterized by at least 6 months of persistent and excessive anxiety and worry (APA, 2000, p. 429).

The diagnosis of these disorders is guided by the *Diagnostic and Statistical Manual of Mental Disorders: DSM-IV-TR* (APA, 2000). It is important to note that only those trained in clinical diagnosis should make such diagnoses; it is inappropriate to diagnose oneself or others by merely examining diagnostic criteria. Similarly, treatment and management is the domain of trained clinicians. While different disorders have different specific recommended treatments, a common form of treatment for mood and anxiety disorders is *cognitive behaviour therapy* (CBT). CBT is based on the notion that thoughts influence feelings and behaviours, and that behaviours have a reciprocal influence on thoughts. It combines behavioural techniques, which focus on modifying behaviours (such as breaking learned associations between ideas/events and creating new more-

adaptive associations) and cognitive techniques, which monitor and challenge dysfunctional thoughts (APS, 2010). CBT often accompanies pharmacotherapy, the exact nature of which depends on the specific disorder and the patient's medical history.

8 Implications for OHS practice

OHS professional practice needs to be underpinned by a knowledge of basic psychology. All of the areas covered above have implications for aspects of OHS practice, because the ways in which humans act, respond, and interact with their environment is fundamental to improving workplace safety. For example, cognitive biases, such as attribution error and just-world hypothesis, are of relevance because they can influence people's estimates and attribution of risk. The behavioural psychology approach has several major implications for the implementation of OHS interventions, including the use of incentive schemes to increase safety performance and behaviour-based safety programs.

8.1 Incentive schemes

Incentive schemes "typically take the form of some type of reward for appropriate behaviour although they can also include attempts to penalise 'unsafe' behaviour" (Bohle & Quinlan, 2000, p. 483). Consider a situation in a medium sized maintenance and repair company, where the management decides to implement an OHS incentive scheme in order to improve OHS statistics. The level of injuries has been increasing for the last 3 years, including broken limbs, falls from heights, cuts and burns and back and shoulder injuries, several of which have required significant compensation and rehabilitation, and consequent lost time to the company. A consultant is contracted to develop the incentive scheme, which is essentially a token economy: employees will be given 'points' which are displayed publically, when they perform regular tasks without injury. Tasks are defined for all different roles in the company so as to ensure fairness. A series of levels of reward are implemented, from company caps at the lower end, to gift vouchers at the higher end. An end-of-year reception is planned to recognise those who have performed most safely with employee awards to be distributed in each division.

What might be the response in such a situation? What particular behaviours are being reinforced? Different schedules of reinforcement have different effects (e.g. reinforcement following a certain number of responses – a ratio schedule, or after a set duration – an interval schedule). In addition, the partial reinforcement effect suggests that giving reinforcement on some occasions and not others make the desired behaviour less likely to dissipate when reinforcement is no longer available.

There are problems associated with the application of such schemes in an OHS context, such as possible manipulation of performance measures and the underlying assumption that the origin of OHS risk is limited to unsafe worker behaviour (Bohle & Quinlan,

2000). Growing recognition of the inadequacy of incentive schemes has manifested in, for example, the NSW *Digging Deeper Project* suggestion that safety incentive schemes be avoided in the mining industry (NSW Mine Safety Advisory Council, 2009). Additionally, incentive schemes do not constitute a complete behavioral based safety (BBS) approach as they do not always include the observation, feedback, and data analysis components of a BBS system. Nonetheless, they are often thought to be 'behavioural' in that they reward particular 'behaviours'; and they also account for some of the criticisms that have been leveled at BBS systems (see, for example Frederick and Lessin, 2000).

8.2 Behaviour-based safety

Though not without its critics, a behaviour-based approach to safety based on behavioural psychology as conceptualised by Skinner has grown in popularity since the 1980s. As explained by Krause (1997), behaviour-based safety (BBS) involves:

> ...use of applied behavior analysis methods to achieve continuous improvement in safety performance. These methods include identifying and operationally defining critical safety-related behaviors, observing to gather data on the frequency of those behaviors, providing feedback, and using the gathered data for continuous improvement. In addition, to actually achieve long-term continuous improvement, these methods need to be coupled with significant employee involvement…It is not the point of behavior-based safety to change human nature, but rather to change the safety culture, to use the nature of behavior in favor of safety instead of against it. (pp. 3, 47)

Geller (2005) proposed seven key principles of BBS:

1. Focus intervention on observable behaviour
2. Look for external factors to understand and improve behaviour
3. Direct with activators and motivate with consequences
4. Focus on positive consequences to motivate behaviour
5. Apply the scientific method to improve intervention
6. Use theory to integrate information, not to limit possibilities
7. Design interventions with consideration of internal feelings and attitudes.

Fundamental to BBS is use of an antecedent-behaviour-consequence (ABC) model that has its roots in operant conditioning and focuses on positive reinforcement of safe behaviours. ABC analysis and ways to apply the scientific method to improve interventions are considered in further detail below.[7]

[7] See OHS BoK Control Prevention and Mitigation, Section 3.7 for a discussion on organizational issues and limitations of BBS as a control measure.

8.2.1 ABC analysis

Antecedent (or activator)-behaviour-consequence (ABC) analysis is used to pinpoint which antecedents and consequences are influencing a particular behaviour. In the work environment, antecedents – events that trigger an observable behaviour – could include time pressures; rules or instructions that may or may not be clear, practical or developed consultatively; lighting, heat or noise; risk-taking tendencies; or cultural issues such as routine ways of performing a particular task or peer pressure. Consequences – events that follow the behaviours – could include staying cool/comfortable, saving time or effort, gaining esteem from colleagues, or avoiding inconvenience or perceived risk of (other) injury. Krause (1997) observed that many well-intentioned safety programs fail because they rely too much on antecedents such as safety rules and procedures, which may not be backed by consequences, the strength of which are determined by timing, consistency and significance. He cited, for example, some competing consequences of workers failing to wear hearing protection – greater comfort and convenience (positives), and the possibility of hearing impairment (negative) – that are likely to have more direct impact on behaviour than an antecedent such as a sign about wearing hearing protection:

> A safety program that tries to motivate the use of personal protective equipment solely by stressing the possibility of hearing loss is relying on the weakest kind of consequence – one which occurs slowly or eventually, if it happens at all, and which is negative...[On the other hand a worker who wears hearing protection] probably receives strong, positive consequences [and is] part of a safety culture that defines this as good performance and consistently gives positive feedback for it. (Krause, 1997, p. 39)

Consequently, BBS should focus on positive rather than negative reinforcement and foster feelings of belongingness, inclusion and empowerment. Interventions can be implemented to increase employees' perceptions that desired behaviours are enacted to achieve success, rather than to avoid failure.

8.2.2 Application of the scientific method

Geller (2005) advocated application of a systematic define-observe-intervene-test ('DO IT') process to cultivating safety-behaviour improvement:

> **D**efine behavior(s) to target
> **O**bserve to collect baseline data
> **I**ntervene to influence target behaviour(s)
> **T**est to measure impact of intervention (Geller, 2005, p. 543).

In describing the DO IT process, Geller (2001) indicates that the observation stage should be conducted once behaviours have been described in a manner that follow the principles of Specific, Observable, Objective and Naturalistic (SOON):

> **S**pecific: behaviours have a concise definition and are unambiguous
> **O**bservable: behaviours are overt, countable and recordable

Objective: behaviours are recordable without interpretation or attribution
Naturalistic: the behaviours reflect real world activities and normal interactions.

Geller (2005) stressed that the observation stage should be a fact-finding learning process, rather than a fault-finding procedure. This needs to be managed carefully with appropriate training to ensure that people do not feel under surveillance, that observations occur with permission, and that feedback is provided in a useful and supportive manner. As described above, ABC analysis can be undertaken to discover why certain behaviours occur and to develop interventions, which can be:

- Instructional (e.g. training exercises, education sessions, feedback, role plays)
- Supportive (e.g. recognition of safe behaviour)
- Motivational (e.g. a reward or incentive scheme)
- Self-directed (involving individual application of the DO IT process) (Geller, 2005).

Geller's approach to BBS "provides tools and procedures employees can use to take control of their own safety performance, thereby enabling a bottom-up empowerment approach to reducing occupational risks and preventing workplace injuries" (Geller, 2005, p. 558). Geller describes the DO IT process (define, observe and providing feedback as an intervention) as applied to driving behaviour. A critical behaviour checklist was developed to enable calculation of a percentage of safe behaviours which were then communicated to the driver with information on which behaviours were 'at risk'. Though it was a one-on-one observation and feedback situation, it demonstrated how the process could lead someone from 'unconscious incompetence' (not knowing what they were doing wrong) to 'conscious incompetence' (being aware of what you're doing wrong), and through to conscious competence (being aware of doing things right) and unconscious competence (performing safely without thinking about it – a safe habit).

Of relevance is Krause's (1997) observation that many companies that have successfully implemented BSB have found that the process necessitated resolving central organisational issues.

9 Summary

This chapter has outlined elements of psychological science most relevant to the generalist OHS professional. After brief consideration of the development of modern psychology, it presented some basic issues in psychobiology to draw attention to the potential for psychological phenomena to have physiological consequences. Salient aspects of behavioural, cognitive and personality psychology; psychological disorders; and implications for OHS practice were discussed. Finally, it is important to stress that

generalist OHS professionals should exercise caution when dealing with areas of psychological practice and should seek specialist advice to address mental health issues in the workplace.

Key authors and thinkers

Skinner, Thorndike, Freud, Baddeley, Costa & McCrae, Kahneman & Tversky, Fischoff, Geller, Theorell & Karasek, Allport, Kobasa

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