Section 1
Chapter 1

Background and theory

Towards a comprehensive model of neuropsychological rehabilitation

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Introduction

Over the past 25 years or so there have been a number of major changes in neuropsychological rehabilitation. First it is now much more of a partnership than it was in the 1970s and 80s. Then doctors, therapists and psychologists decided what patients should and could hope to achieve from rehabilitation programmes. Now we discuss with families and patients what they hope to get from rehabilitation and we try to accommodate to this at least in part. Second, rehabilitation has moved well beyond the drills and exercise approach. We no longer find it acceptable to sit people in front of a computer or workbook in the belief that such exercises will result in improved cognitive and, more importantly, social functioning. Third, rehabilitation staff now follow a goal setting approach when planning rehabilitation programmes. Clients, families and staff negotiate appropriate goals and determine how these are to be achieved. Fourth, there is increasing recognition that the cognitive, emotional, social and behavioural consequences of brain injury are interlinked and all should be addressed in the rehabilitation process. Fifth, technology is playing a larger part than ever before in helping people with cognitive deficits compensate for their problems. Sixth, it is now more widely accepted that no one model, theory or framework is sufficient to deal with the many and complex difficulties faced by people with neuropsychological impairments following an injury or insult to the brain. Instead we need to draw on a number of models, theories and frameworks in order to achieve the best outcomes for those people requiring neuropsychological rehabilitation. We can see rehabilitation as a process whereby people with brain injury work together with health service staff and others to ameliorate or alleviate deficits that result from an insult to the brain. The main purposes of rehabilitation are to enable people with disabilities achieve their optimum level of wellbeing, to reduce the impact of their problems on everyday life and to help them return to their own most appropriate environments.

Of the many theories, models and frameworks that impact on rehabilitation, five areas are, perhaps, of particular importance, namely those of cognitive functioning, of emotion, of social interaction, of behaviour and of learning. Representative examples from each of these areas are described below. Models of relevance to the organization of the multidisciplinary team's work are presented. Consideration must also be given to theories and models of assessment, recovery and compensation. Following consideration of models

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representing aspects of these domains, a tentative, comprehensive model of neuropsychological rehabilitation is provided in an attempt to integrate the above-mentioned models and theories into a unified whole.

Theories and models of cognitive functioning

A number of models of cognitive functioning have proved helpful in rehabilitation. Models and theories of language, for example, have influenced the rehabilitation of people with aphasia over the past 15 or so years. Indeed, this is probably the area where such models first made their mark in rehabilitation (e.g. Byng and Coltheart, 1986). In 1991 Coltheart stated that in order to treat a deficit it is necessary to fully understand its nature and to do this one has to have in mind a representation of how the function is normally achieved. Without such a representation one cannot determine what kinds of treatment would be appropriate. Coltheart and others believe that cognitive rehabilitation should be based on theoretical models from cognitive neuropsychology. While we believe that this is too restrictive for reasons mentioned above, we accept that models of cognitive functioning are necessary to help us identify and understand the specific cognitive strengths and weaknesses of our clients. In other words these models are necessary but not sufficient. This view was put forward by Caramazza (1989) when he said 'There is nothing specifically about our theory of the structure of the spelling system (or reading system, the naming system, the sentence comprehension system and so forth) which serves to constrain our choice of therapeutic strategy. Merely "knowing" the probable locus of a deficit … does not, on its own allow us to specify a therapeutic strategy. To do so requires not just a theory of the structure of the damaged system but also, and more important, a theory of the ways in which a damaged system may be modified as a consequence of particular forms of intervention' (p. 382).

These models do not tell us how to rehabilitate people as they do not identify everyday problems or inform us how to treat a particular problem. Instead they tell us what bit of the model is malfunctioning. Their strengths lie in the fact that they tell us what the cognitive constraints are on any programmes we wish to implement; they also enable us to conceptualize processes, make predictions about intact cognitive functions and explain impairments to patients, relatives and staff. Some models have been invaluable in the identification of deficits. Take, for example, the dual route model of reading (Coltheart, 1985). This model postulates that there are at least two ways one can read a written word, namely the lexical (or whole-word route) and the phonological route whereby one converts letters to sounds. Take the word 'mint'. This can be read by either route; we can sound out M-I-N-T which conforms to the normal phonemic rules of English and it is also a known word so it is in our lexicon, our word knowledge store. In contrast, the word 'fint', a nonsense word that does not exist in English, can only be read via the phonological route. It is not in our word store because we have not met it before. With the word 'pint', however, we have to use the word knowledge store to read it correctly. If we used the letter-to-sound rules or the phonological route we would read this incorrectly as rhyming with mint. When Coltheart was developing this model he predicted that it would be possible to find patients with a deficit in the phonological but not the lexical route and vice versa. At that point such patients had not been identified so Coltheart assembled a screening test and he asked his clinical psychology and speech therapy colleagues working with neurologically impaired people to administer the screening test. Once this happened, the patients Coltheart predicted we would find *were* found. Those unable to read nonsense words like 'fint' are now said to have a 'phonological dyslexia' and those unable to read irregular

words like 'pint' are said to have a surface dyslexia. Not only has this model enabled us to explain such phenomena, but it has also resulted in a profound change in the assessment of acquired disorders of reading, over the past 20 or so years. In the 1970s most neuropsychological assessments of patients' reading abilities (at least in the United Kingdom) comprised of word lists such as The Schonell Graded Word Reading List and perhaps The Neale Analysis of Reading Ability to look at reading comprehension. Now we assess a wide variety of reading skills such as regular versus irregular words; concrete versus imageable words; parts of speech; word length; age of acquisition and so forth. This vast change came about as a direct result of theories of reading and language. Because these models tend to identify impairments rather than everyday problems they do not tell us *how* to rehabilitate people; they tell us what bit of the model is malfunctioning and not how to treat a particular problem.

It is not only in language that models of cognitive functioning have played a part. Take the influential Working Memory Model of Baddeley and Hitch (1974), originally put forward as a temporary stopgap model until something superseded it, which is still a useful model to this day. This has allowed us to conceptualize memory disorders, to understand why someone can have a normal immediate memory but problems after a delay or distraction or can have a normal phonological loop and visuo-spatial sketchpad but poor executive skills. Indeed the 'Central Executive' component of the Working Memory Model and the conceptually similar view of the Supervisory Attentional System put forward by Norman and Shallice (1980) has been of considerable influence in the understanding and assessment of the Dysexecutive Syndrome (which used to be more popularly known as the 'Frontal Lobe Syndrome'). There will be more of this later when we discuss the rationale behind the Problem Solving Group (Chapter 6).

Models of attention, perception and face processing among others have all played a part in helping us to understand cognition and the breakdown of cognition in people with brain injury. We need this understanding of cognitive functioning in order to get a good grasp of what is impaired and what is intact in the clients referred for neuropsychological rehabilitation, but we stress once again that an understanding of cognitive functioning is only part of the whole picture. As research into the interactions between cognition and emotion continues in the field of mental health (Harvey *et al.* (2004) present a thorough systematic review), a new challenge for neuropsychology emerges. This is how we model and assess aspects of cognition that may be fluid and dynamic rather than static, that appear to adapt according to the social and emotional salience of a situation, when trying to understand and do therapy or rehabilitation with clients with neurological problems.

Theories and models of emotional functioning

The management and remediation of the emotional consequences of brain injury has become increasingly important over the last 15 years. Prigatano (1999) suggests that rehabilitation is likely to fail if we do not deal with the emotional issues. Consequently, an understanding of theories and models of emotion is crucial to successful rehabilitation. Social isolation, anxiety and depression are common in survivors of brain injury (Fleminger *et al.* 2003; Wilson, 2004). McKinlay *et al.* (1981) thought that about two thirds of people surviving traumatic brain injury (TBI) would experience anxiety and depression. Seel *et al.* (2003) found that, in a sample of 666 out-patients with traumatic brain injury evaluated 10 to 126 months after injury, 27% met diagnostic criteria for major depressive disorder. Evans and Wilson (1992) found that anxiety was common in people

attending a memory group. Kopelman and Crawford (1996) found that 40% of 200 consecutive referrals to a memory clinic were suffering from clinical depression. Bowen *et al.* (1998) found that 38% of survivors of TBI experienced mood disorders. Williams *et al.* (2003) found that the prevalence of post-traumatic stress disorder (PTSD) following TBI ranges from 3% to 27%. In their own study they found 18% of 66 community living survivors of TBI experienced symptoms associated with PTSD. Deb *et al.* (1999) carried out diagnostic interviews using the International Classification of Diseases (ICD-10) with 164 TBI patients 1 year post-injury, finding 21.7% had a diagnosable psychiatric illness.

Gainotti (1993) distinguishes three main factors causing emotional and psychosocial problems after brain injury. First there are those resulting from neurological factors; second are those due to psychological factors and third are those due to psychosocial factors.

Neurological factors

An example of the first type of cause might be someone with brainstem damage leading to the so-called 'catastrophic reaction' (or pathological laughter and crying) in which swings from tears to laughter may follow in rapid succession. Anosognosia, or lack of awareness of one's deficits, is also frequently due to organic impairment. An important book on the topic of unawareness was published in 1991 (Prigatano and Schacter); it includes several rationales for the existence of anosognosia. Gainotti (1993) also addresses unawareness in some detail. Damage or disruption to fronto-temporo-limbic pathways is also associated with changes in the regulation and experience of affect (e.g. Starkstein and Robinson, 1991; Eames and Wood, 2003). Other models and theories that need to be taken into account are those of premorbid personality and neurological, physical and biochemical models such as those described by Robinson and Starkstein (1989). This addresses the issue of why emotional problems arise following an insult to the brain, but does not offer much help in understanding the psychological and psychosocial causes of emotional and mood disorders. With an increasing base of research related to cognitive processes, emotion and underlying neuroscience, the field of cognitive behavioural psychotherapy offers some helpful ideas.

Psychological factors

The second cause in Gainotti's three part classification (Gainotti, 1993) is where emotional problems are due to psychological or psychodynamic causes, including personal attitudes towards the disability. Goldstein (1959) was among the first to describe the emotional reaction to brain injury, noting how a 'catastrophic reaction' may arise whereby the individual withdraws or avoids situations or activities. This results in both maintenance of fears (as these remain unchallenged) as well as increasing disability through disuse of intact functions. Ben-Yishay (2000) describes this as a 'behavioural manifestation of threat to the person's very existence'. An example would be someone with an acquired dyslexia and consequent loss of self-esteem together with depression because of an inability to read, who avoids reading and mixing with peers, resulting in maintenance of depression and potential loss of other skills. Denial is also thought to be a relevant psychological process influencing the emotional outcome after injury. At some level patients are aware of their disabilities, but are unable to accept them. Caplan (1987) provides a readable account of denial. As denial can occur in conditions without any damage to the brain, there must (at least in some cases) be non-organic reasons for its cause (Gainotti, 1993). Post-traumatic stress disorder (which we discuss below) would also fit into this section. Fear of what might happen in the future, panic because one cannot

remember what has happened in the last few minutes, grief at loss of functioning and reduced self-esteem because of changes in physical appearance may all contribute to emotional changes. There has been a significant amount of research into forms or categories of coping and the relationship of these to outcome, some of which is summarized in Godfrey *et al.* (1996) stress-appraisal-coping model. These approaches converge on the therapeutically oriented cognitive-behavioural model, in that relationships between cognitive content (thoughts, beliefs, appraisals, assumptions, etc.), emotion and behaviour are hypothesized.

Ever since Beck's highly influential book *Cognitive Therapy and the Emotional Disorders* appeared in 1976, cognitive behaviour therapy (CBT) has become one of the most important and best validated psychotherapeutic procedures (Salkovskis, 1996). An update of Beck's model appeared in 1996 (Beck, 1996). One of its major strengths has been the development of clinically relevant and applicable research findings and models, and the challenging of some of the initial tenets of CBT by a broad research effort. This has resulted in a range of models applicable to mental health problems (depression, anxiety disorders, schizophrenia) and adjustment to health problems (e.g. pain, cancer). Pointing to the development of bridges between the cognitive and emotional, developments in the field of cognitive behavioural therapy now suggest that emotional processes such as worry and rumination are associated with disruption of memory, attentional and executive systems (Harvey *et al.*, 2004). It is these processes that are thought to be at least as important in vulnerability to disorders as the negative 'core beliefs' as originally described by Beck (e.g. Beck *et al.*, 1976). There is some evidence that integration of attention training skills into CBT following brain injury enhances efficacy (Mateer *et al.*, 2005; Tiersky *et al.*, 2005). The grounding of psychotherapy research in basic and cognitive neuroscience has also led to new ideas about ways of changing feelings and expression of anger (e.g. Paul Gilbert's (2000) use of compassionate mind training). Such developments in the mainstream of cognition-emotion and CBT research are ripe for application with survivors of brain injury.

Williams *et al.* (2003) discuss the use of CBT with two survivors of TBI. One was a young man whose girlfriend was killed in a car crash when he was driving. The other was a young woman who had been severely assaulted whilst travelling on a train. We describe her case and treatment later in this book (Caroline, Chapter 15). Williams *et al.* discuss the possible mechanisms for PTSD after TBI. These conditions were once thought to be mutually exclusive because the survivor would lack a memory for the event from which to develop vivid intrusive cognitions and avoidance behaviours (Sbordone and Leiter, 1995). However, given that PTSD seems to occur even when there is a loss of consciousness for the event, there could be two main mediating mechanisms to suggest how trauma-related material may be processed to lead to PTSD symptoms. First, survivors may recall 'islands of memory' for their trauma such as being trapped in the crashed car, or other secondary experiences, that could fuel intrusive ruminations (McMillan, 1996). Second, the survivors may be reminded of elements of their trauma event when exposed to similar situations, which serve to produce intrusive thoughts and fuel avoidance behaviours (Brewin *et al.*, 1996). Developments in the field of social neurosciences and the cognitive neuroscience of emotion allow us to think about the brain systems involved in this type of process. For example, the model of fear processing proposed by Joseph LeDoux (1996) allows us to understand how, at the neurological level, PTSD with loss of consciousness for the event may occur (see Brewin, 2001). McNeil and Greenwood (1996) described a survivor of TBI who was hyperaroused in, and avoidant of, situations that were similar to the trauma event, a road traffic accident, even though he had no declarative memory of the event. They

suggested that, if an event is unexpected, but has biological significance and, hence, emotional salience, it may lead to the event being stored (or 'burned in' to memory) despite disruption to areas of the brain that store declarative memories (see Markowitsch, 1998). Such a view would be compatible with the view that PTSD is due to a conditioning of fear. The mechanism responsible is that traumatic experiences can be processed independently of higher cortical functions (see Bryant, 2001). The model proposed by Joseph LeDoux suggests that frontal areas influence the inhibition of a previously conditioned fear response. King (2000) describes a case of PTSD following brain injury where executive impairment was present. The standard approach of exposure and restructuring work (from a CBT model) was applied, but the detailed recounting of the trauma resulted in what the authors call 'perseveration of emotional responding'. This discussion about the alteration of a well-understood psychiatric disorder when it occurs in the context of organic brain injury highlights the need to be cautious in our application of models of emotional disorder, such as those derived from CBT, when working with those with brain injury. Further research efforts are required to help build therapeutic models that integrate such issues.

As the traditionally intrapersonal fields of CBT and neurosciences grapple with integrating the basic science of brain systems involved in cognition and emotion, it is becoming clearer that processing of social context is central to the way in which emotions, behaviour and higher cognition is regulated. These ideas are supported through recent studies highlighting the impact of social context on awareness (Schönberger *et al.*, 2006; Yeates *et al.*, 2007), identity (Cloute *et al.*, 2008) and wellbeing (Haslam *et al.* 2008). Thus the UK legislative guidance to involve family members (*National Service Framework for Long Term Conditions*, Department of Health, 2005) is now followed by theoretical support highlighting models of cognition and adjustment that are intimately tied to social context.

Thus, whilst one aspect not explicitly covered by Gainotti (1993) is the influence of pre-injury personality, culture, beliefs, values, goals, lifestyle and experiences, to some extent these ideas are represented in the growing body of work covered here. Further discussion is provided by Moore and Stambrook (1995), Tate (2003), Williams (2003) and Yeates *et al.* (2007).

Social factors

The third category put forward by Gainotti (1993) includes problems that arise for psychosocial reasons. An example of this might be someone who loses all his/her friends and colleagues following a brain injury and is thus very socially isolated. The social judgments of others and the impact of these on sense of self (Nochi, 1998), in addition to the important role of social group membership (Haslam *et al.*, in press), have also been highlighted, recognizing the need to include social models in our thinking about the consequences of brain injury and rehabilitation.

The field of psychoanalysis, not typically considered an obvious choice for understanding the consequences of brain injury, is receiving renewed attention in the light of social and emotional neurosciences research. The approach brings a stronger emphasis on understanding the social and interpersonal in conjunction with the intrapsychic than is usually assigned to cognitive-behavioural models. One well-known proponent of this for the treatment of people surviving TBI is Prigatano. He describes his approach, based on the milieu-oriented approach of Ben-Yishay, and integrating ideas from Jungian psychotherapy, in his book *Principles of Neuropsychological Rehabilitation* (Prigatano, 1999). The

growing Neuro-Psychoanalysis movement seeks to develop explicit research, theory and clinical links between psychoanalytic theory and the neurosciences. Kaplan-Solms and Solms' (2002) book *Clinical Studies in Neuropsychoanalysis* marks out the territory in this developing field. The ideas of Antonio Damasio (e.g. 1998), and Frith and Wolpert (2003), also allow some integration of biological, psychological and social factors.

It seems our tripartite system of biological, psychological and social domains is becoming increasingly difficult to partition, and equally ideas about the separation of cognition and emotion are equally difficult to maintain. In this respect the ideas of Vygotsky (1960/1978) regarding the development of higher psychological processes as mediated by the biological and social can perhaps be viewed in an encouraging new light.

Theories and models of behaviour

Models and theories from behavioural psychology have been employed in neuropsychological rehabilitation for more than 40 years. They have provided some of the most useful and influential theoretical contributions to rehabilitation, not only for the understanding, management and remediation of disruptive behaviours but also for the remediation of cognitive deficits (Wilson, 1987, 1991, 1999; Wilson *et al.*, 2003). Behavioural theories are valuable in neuropsychological rehabilitation because they benefit assessment, treatment and the measurement of rehabilitation efficacy.

The principles involved in theories of behaviour come from research in social and experimental psychology (Franks and Wilson, 1975). This includes learning theory, which we cover in the following section. The principles involve environmental change and social interaction rather than the use of biological procedures to bring about change (Frank and Wilson, 1975).

Kazdin and Hersen (1980) suggested that followers of the behavioural approach have four main characteristics:

i) A strong commitment to the empirical evaluation of treatment and intervention techniques
ii) A general belief that therapeutic experiences must provide opportunities to learn adaptive or prosocial behaviour
iii) Specification of treatment in operational and, hence, replicable terms
iv) Evaluation of treatment effects through multiple-response modalities with particular emphasis on overt behaviour (p. 287).

The underlying theoretical frameworks of behavioural approaches come from a number of fields including learning theory, neuroplasticity, information processing, linguistics, psychiatry, and so forth. This richness and complexity of theoretical support and clinical treatment means that behavioural medicine can be applied to a wide range of patients, problems and situations. Although there is a wide variety of behavioural assessment and treatment techniques, they tend to share common themes. First, all are concerned with the development of reliable and valid assessment instruments. Pearce and Wardle (1989) believe these instruments are the hallmark of the behavioural scientist. Second, liaison with other disciplines is another characteristic of behavioural medicine. From its beginnings in learning disability to its wide application in many medical conditions, such as diabetes, chronic pain, obesity, addiction and brain injury, behavioural scientists frequently work in multidisciplinary and interdisciplinary teams making such liaison

crucially important to success. Third, all behavioural methods involve careful monitoring and evaluation of treatment efficacy. This is often done at the individual level and the widespread use of single case experimental designs grew directly out of behavioural psychology (Wilson, 1987).

Wilson *et al.* (2003), in a book about behavioural approaches to neuropsychological rehabilitation, suggest the following reasons for the success of behavioural methods for the treatment of people with brain injury, namely:

1. There are many treatment techniques to either decrease problem behaviours or increase desirable behaviours that can be adapted or modified for use with our patient population.
2. The targets, aims and goals of therapy are made clear from the beginning of each programme. Unlike, say, interpretative psychotherapy that arrives at its specification at the *end* of therapy, behavioural approaches specify the goals at the beginning of the process. Furthermore, the goals are explicit, small and usually easy to achieve.
3. Assessment and treatment are frequently inseparable in behavioural treatment programmes, unlike other treatments. Neuropsychological or cognitive assessments, for example, are typically unrelated or indirectly related to the treatment. Poor scores on intelligence tests or memory tests are not targeted for treatment; we do not teach people to pass these tests. The scores are important in helping us to understand a person's cognitive strengths and weaknesses and help us plan our interventions appropriately but they do not inform us in any detail about everyday problems, how families cope, what brain injured people want to achieve or how environments may affect behaviour. For such information we must employ behavioural assessments that are often part of the treatment strategy itself.
4. Behavioural interventions are continuously monitored. Without measurement we are in danger of giving subjective or intuitive opinions about behavioural change or treatment effectiveness. Some of the most valuable evaluation techniques in neuropsychological rehabilitation are the single case experimental designs developed in the field of behavioural medicine. These designs help us tease out whether change is due to natural recovery (or some other non-specific factor) or to our intervention.
5. Within a behavioural approach it is possible to individualize treatment and this is particularly helpful for some brain injured patients who will probably not respond to 'packaged treatment' such as computerized cognitive retraining or memory exercises. These 'packaged' programmes have not been designed to take into account the complex mixture of cognitive, social, emotional and behavioural programmes of brain injured people and may have not been properly evaluated. In contrast, behavioural programmes typically take into account the biological condition of the individual, precipitating events, consequences of events, social factors and the environment in which the individual is functioning. 'Lesions in the same general areas do not always show the same symptoms and potential for restitution' (Finger and Stein, 1982), thus a more individually oriented approach to therapy is called for, 'one that would take into account not only features of the lesion, but factors such as motivation, age, experiential history, and the status of the rest of the brain' (Finger and Stein, 1982).
6. Behavioural approaches provide a set of principles and a structure to follow when designing treatment programmes. Task analysis, goal setting, appropriate and detailed assessments, recording, monitoring and evaluating the programme provide sound guidelines for psychologists, therapists or teachers to follow.

7. Numerous studies testify to the success of behavioural approaches in neuropsychological rehabilitation (e.g. Taylor and Persons, 1970; Lincoln *et al.*, 1982; Alderman, 1996, Wilson, 1999).

Models and theories of learning

Learning theory is one of the cornerstones of behaviour therapy and behaviour modification, the other main theoretical influences coming from biological, cognitive and social psychology (Martin, 1991). There is little doubt, though, that the original behavioural treatments grew out of learning theory. Eysenck (1964) for example defined behaviour therapy as 'the attempt to alter human behaviour and emotion in a beneficial manner according to the laws of modern learning theory' (p. 1). Wolpe (1969) said it was 'the use of experimentally established principles of learning for the purpose of changing unadaptive behaviour' (p. vii). Martin (1991) says 'the inspiration for the development of numerous therapeutic techniques has come from theories and findings in the learning literature' (p. 2). A widely accepted definition of learning is that by Kimble (1967) who said that learning is a relatively permanent change in behaviour that occurs as a result of reinforced practice. The most important learning theories leading to early behaviour modification techniques were those of classical and (even more importantly) operant conditioning. Watson (1913) and Skinner (1938 and 1953) are, perhaps, the names most associated with operant conditioning, but people such as Rescorla (1966), Lovaas (1967) and Kazdin (1978) were some of the most important names in bringing operant conditioning principles into clinical practice through their work with people having severe developmental learning difficulties. Most psychologists in rehabilitation today who have been influenced by principles from operant learning theory do not adhere to the rigid behaviourism of the past. Instead they modify these procedures or just use some of the component elements such as task analysis, shaping procedures and behavioural assessments to make them appropriate for clients with brain injury. Furthermore, learning theories are often combined with other theoretically driven approaches in an attempt to provide the best clinical practice for people with brain injury.

One theory of learning that has been very influential in rehabilitation is errorless learning first described by Terrace (1963). Errorless learning is a teaching technique whereby people are prevented, as far as possible, from making mistakes while learning a new skill or acquiring new information. Instead of learning by trial and error, the correct responses are presented or demonstrated until the behaviour is established. This is followed by a gradual fading out of the support or prompts. In other words, this is an approach whereby the task is manipulated to eliminate or reduce errors. Typically, tasks are gradually made more difficult (even though this may increase errors) both to approximate real life and to maintain attention during therapy. Terrace's work was with pigeons but errorless learning principles were soon adapted for use with people with developmental learning disabilities (Sidman and Stoddard, 1967; Cullen, 1976; Walsh and Lamberts 1979). Still widely used for the teaching of self care and cognitive skills in learning disability, it has only recently been widely used in cognitive rehabilitation (although Wilson (1981) describes its use in this field since the late 1970s). The reason errorless learning is now accepted in cognitive rehabilitation came about because of a second theoretical impetus, namely research into implicit learning (i.e. learning in the absence of conscious recollection). We have known for many years that people with severe memory deficits can learn certain skills or information normally or nearly normally despite having no conscious memory of having

seen the task or information before. This is known as implicit memory in contrast to explicit memory where there is conscious recollection that one has been exposed to the information earlier. In 1994, Baddeley and Wilson demonstrated the superiority of errorless over errorful learning for people with severe memory disorders following non-progressive brain injury. The first study was a theoretical study suggesting that errorless learning was beneficial for memory-impaired people because it capitalized on their intact (or relatively intact) implicit learning system. It was suggested that in order to benefit from our mistakes, we need to remember our mistakes and to do this one needs an episodic memory. In the absence of this system one has to depend on implicit memory, which is not good at error elimination. In these circumstances it is better to avoid errors so they do not become strengthened or reinforced. Page *et al.* (2006) confirm the importance of implicit memory in errorless learning.

Wilson *et al.* (1994) also demonstrated the effectiveness of errorless learning for teaching real-life tasks to a variety of people with severe memory problems. The group included people with different diagnoses (e.g. TBI, stroke, encephalitis), of different ages and of different times post-insult. A series of studies by Linda Clare and her colleagues showed that errorless learning is also a useful method for teaching practical, everyday information to people with dementia of the Alzheimer type (Clare *et al.*, 1999, 2000, 2001). In some instances, information taught is well retained at 1–3 years follow-up despite the fact that the disease is progressing. Potentially this is an important clinical finding suggesting that some practical information can be taught in the early/moderate stages of Alzheimer's disease that can be retained (possibly with practice) when the disease progresses and could enable people with dementia to remain for longer outside institutional care.

At present the conclusions to several research studies into errorless learning are that, first, it is superior to trial-and-error learning for people with memory deficits; second, active participation is required; third, other principles from learning theory and memory rehabilitation should be incorporated into treatment; fourth, it is not clear whether errorless learning is the method of choice for people with cognitive problems other than memory (e.g. language) nor whether it is the better/best method for other problems (e.g. motor difficulties).

In addition to the behavioural principles and cognitive models of learning highlighted above, there is a need to ensure learning is generalized beyond the treatment setting or clinical session and maintained over time. Whilst for many, generalization training involving stepped strategy use and skills training in relevant contexts, environmental supports and changes is the only option, some may be able to undergo a deeper process of personal change and adjustment. Developments in the field of cognitive behavioural therapy (Bennett-Levy *et al.*, 2004) and the underlying research base (e.g Teasdale and Barnard 1993; Conway and Pleydell-Pearce, 2000) point to the importance of experiential learning in catalysing changes in the cognitive representations that guide our sense-making and personally salient goal directed activity, especially of those in emotional distress. Carver and Scheier's (1990) 'goal process' account of emotion suggests that discrepancy between a personally salient goal and current status in relation to that goal determines our emotion. So making good progress to such a goal is thought to underpin good mood, whilst encountering barriers to reaching a goal may engender frustration or anger. Thus there is both theoretical and research grounds to focus on the relationship between activity, personally meaningful goals, expectations or beliefs, and identity in the practice of rehabilitation. Joanna McGrath (e.g. McGrath and King, 2004) and Mark Ylvisaker (e.g. Ylvisaker