A Memory Aids Clinic for the Rehabilitation of Acquired Memory Disorders

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A Memory Aids Clinic for the Rehabilitation of Acquired Memory Disorders

Bonnie-Kate Dewar

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ABSTRACT

Acquired memory impairment commonly occurs after acquired brain injury such as traumatic brain injury, stroke, seizure disorder and encephalitis and is one the defining features of progressive disorders, such as Alzheimer’s disease. There is a growing body of knowledge about the use of compensatory memory aids in the rehabilitation of memory disorders. This study investigated the effect of the systematic training of compensatory memory aids on everyday memory performance within a Memory Aids Clinic, a specialised outpatient clinic which supplied and trained the use of memory aids.

A comparison was made between subjects with acquired memory disorders in a treatment group (n=63) and control group (n = 28) in a between subjects design. All subjects underwent a baseline session which was comprised of a neuropsychological assessment, clinical interview and goal setting session. Treatment subjects then underwent three training sessions, matching memory aids to goals, across a six week period. Training was based upon Sohberg and Mateer’s (1989) application, acquisition and adaptation program. A follow-up session was conducted 12 weeks after the conclusion of training and included a review neuropsychological assessment and interview. Following the baseline session, control subjects were given written information about the management of memory problems and placed on an 18 week waiting list, prior to the three treatment sessions. The main outcome measure was everyday memory performance as assessed by a memory goal attainment diary. This was administered at baseline, the end of training and at the follow-up session. Outcome was also measured in terms of neuropsychological performance and performance on measures of mood, self-esteem, subjective memory performance, participation and carer strain. Generalisation was measured in terms of performance on a Problem Solving Inventory, a list of hypothetical memory scenarios which was developed for this study.

The systematic training of memory aids in a Memory Aids Clinic was effective in improving everyday memory performance, but only across time from the end of training to follow-up. A significant difference in goal attainment was evident between
the treatment and control group at follow-up but not at the end of training. Further analysis confirmed a significant treatment effect for participants with a non-progressive condition but not a progressive condition. This pattern is further illustrated by a series of case reports describing in detail the training content in the Memory Aids Clinic for both non-progressive and progressive subjects. In contrast to previous literature, there were no demographic or neuropsychological profile predictors of outcome in the current study. In addition, training in the Memory Aids Clinic did not impact upon the psychosocial measures of mood, self-esteem, participation, subjective memory function or carer strain. The treatment effect did generalise to the Problem Solving Inventory, notably for subjects with a progressive condition, suggesting adaptation of training to similar but diverse memory scenarios.

Systematic training within the setting of a Memory Aids Clinic is beneficial for individuals with acquired memory problems as a consequence of a non-progressive condition. Improvement in everyday memory performance was attained with three training sessions and maintained across time. Training requires matching the memory aid to the client’s goals and scope remains for extension of training to encompass awareness of when to use the memory aid and acceptance of memory problems. Whilst the current results indicated that individuals with progressive memory disorders did not benefit from training in the Memory Aids Clinic, it is premature to suggest that this group cannot benefit from the use of memory aids. Additional training sessions may be required to facilitate generalisation into the home environment, to enhance the use of a significant other as co-therapist and to consolidate initial gains. A different and more general approach to using memory strategies including compensatory aids may be more beneficial in this group given more widespread and severe cognitive impairments. Finally, the results of the current study highlight the need for ecologically valid measures of outcome, including appropriate tools to determine self-efficacy and participation.
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<td>ABI</td>
<td>Acquired Brain Injury</td>
</tr>
<tr>
<td>AD</td>
<td>Alzheimers Dementia</td>
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<tr>
<td>ADL</td>
<td>Activity of Daily Living</td>
</tr>
<tr>
<td>BDI II</td>
<td>Beck Depression Inventory (second edition)</td>
</tr>
<tr>
<td>CIQ</td>
<td>Community Integration Questionnaire</td>
</tr>
<tr>
<td>CSI</td>
<td>Carer Strain Index</td>
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<td>GMT</td>
<td>Goal Management Training</td>
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<tr>
<td>ICF</td>
<td>International Classification of Functioning</td>
</tr>
<tr>
<td>MAC</td>
<td>Memory Aids Clinic</td>
</tr>
<tr>
<td>MCI</td>
<td>Mild Cognitive Impairment</td>
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<tr>
<td>NART-R</td>
<td>National Adult Reading Test- Revised</td>
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<tr>
<td>PDA</td>
<td>Personal Digital Assistant</td>
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<td>PRMQ</td>
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<td>RBMT-E</td>
<td>Rivermead Behavioural Memory Test- Extended version</td>
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<tr>
<td>RCI</td>
<td>Reliable Change Index</td>
</tr>
<tr>
<td>RCT</td>
<td>Randomised Controlled Trial</td>
</tr>
<tr>
<td>SLE</td>
<td>Systemic Lupus Erythematosus</td>
</tr>
<tr>
<td>TBI</td>
<td>Traumatic Brain Injury</td>
</tr>
<tr>
<td>TEA</td>
<td>Test of Everyday Attention</td>
</tr>
<tr>
<td>WASI</td>
<td>Wechsler Abbreviated Scale of Intelligence</td>
</tr>
<tr>
<td>WAIS 3</td>
<td>Wechsler Adult Intelligence Scale third edition</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organisation</td>
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<td>WTAR</td>
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1. INTRODUCTION

Memory impairment commonly occurs after acquired brain injury such as traumatic brain injury, stroke or encephalitis. Impaired memory is also one of the defining features of Alzheimer’s Disease and occurs in other neurodegenerative disorders to varying degrees. It is well established that memory impairment can have a negative impact upon an individual’s ability to live independently and return to their premorbid level of community participation (Ben-Yishay & Diller, 1993; Sohlberg, 2005), and a potentially devastating effect on an individual’s adjustment to their injury with subsequent mood and anxiety disorders (Tate, 2002). In recognition of the negative consequences of memory impairment on an individual’s independent living post injury or illness, rehabilitation techniques have been developed to manage memory difficulties. This chapter will begin with a general overview of the rehabilitation of acquired memory impairments. The use of compensatory memory aids will then be reviewed, with discussion of both low and high technology memory aids in the rehabilitation of acquired memory disorders secondary to progressive and non-progressive brain injury. Whilst this literature review provides some support for the use of compensatory memory aids in rehabilitation, the final part of this chapter will focus on the methodology for training effective use of memory aids.

1.1. Memory Rehabilitation

Rehabilitation has been defined as the use of any strategy or technique that enables people with brain injury to bypass or reduce cognitive deficits in order to function as adequately as possible in an environment that is most appropriate to them (Wilson & Evans, 2003). The emphasis on an individual’s ability to function adequately in their own environment reflects the World Health Organisation’s International Classification of Functioning, Disability and Health (2001) which focuses upon the impact of an impairment on an individual’s ability to function and limitations on participation. With respect to memory rehabilitation, such a framework suggests the need to identify any strategy or technique that will assist individuals with acquired memory disorders to actively function and participate in their desired environment. Traditionally, approaches to memory rehabilitation have been classified on the basis of the mechanisms purported to underlie recovery that of restoration of function or compensation for lost function. Restorative approaches to memory impairment aim to
restore lost function by systematic retraining (Ben-Yishay & Diller, 1993; Tate, 1997). Early attempts to directly restore memory function included repetitive memory drills, such as list learning, which were based on the assumption that memory responds like a ‘mental muscle’ (Tate, 1997; Miller, 1992) and that exercising it on one task will strengthen it for use on other tasks, including daily situations that involve those core memory functions. However, whilst performance may improve upon the training task, there has been little evidence of generalisation of training to other tasks or activities of daily living. In contrast, some success has been reported in the training of domain specific information, such as name-face associations (Clare et al., 2000; Dewar et al., 2009), and task-specific instructions, such as computer skills (Glisky et al., 1986). Training domain-specific knowledge and instructions can be seen as an attempt to restore impaired memory function through the recruitment of alternate and intact functional systems (Tate, 1997).

Substitution of an intact skill to overcome a functional impairment includes the use of mnemonics/visual imagery. Mnemonics include techniques such as visual imagery or semantic associations to link stimulus and response words or the ‘method of loci’, where items to be remembered are linked to a specific imagined location (Tate, 1997). This technique has been used favourably in the training of name and face associations (Theone & Glisky, 1995). However, the lack of generalisation to other daily tasks demonstrates the narrow focus of such substitution rehabilitation techniques. Visual imagery techniques have been criticised as requiring complex processing and sustained attention for success and that these cognitive abilities are typically compromised in people with acquired memory disorders.

Error reduction techniques have also proved useful in the training of specific and relevant items of information. Baddeley and Wilson (1994) demonstrated that amnesic subjects learn better and show less forgetting when they are prevented from making mistakes during the learning process. There are a number of ways that errors can be eliminated during learning, such as breaking down a task into small steps, providing models before the client is asked to perform a task, encouraging the client to avoid guessing, immediately correcting errors and fading prompts (Sohlberg et al., 2005). Such errorless learning techniques attempt to eradicate the errors that are difficult to correct in individuals with severe explicit memory problems. These
training techniques assume that memory is not uniformly impaired and that intact procedural or implicit memory can be utilised to target specific impairments. Glisky and colleagues (Glisky et al., 1986) reported a series of treatment studies using the method of vanishing cues to train domain-specific knowledge for the work place. In this error reduction method, prompts are provided and then gradually faded out (Wilson, 2009). To learn new information, the subject was provided with increasing hints over successive trials regarding the correct word for computer commands. Their subject was able to learn a series of computer commands and successfully return to a confined work role. However training was extremely labour-intensive and generalisation of learning information was limited. Another error reduction method is spaced retrieval (also known as expanded rehearsal). This technique involves the presentation of material to be remembered followed by immediate testing and then a gradual lengthening of the retention interval (Wilson, 2009). Part of its effectiveness may be that it represents a form of distributed practice. Errorless learning techniques, such as vanishing cues and expanded rehearsal, have been used to retrain new information or skills in amnesic individuals (Evans et al, 2000; Dewar et al., 2009; Tailby & Haslam, 2003), aphasic cases (Fillingham et al, 2006) and people with Alzheimer's disease (Clare et al, 1999; 2000; 2002; Haslam et al, 2006).

In contrast to direct retraining and restoration of impaired function, compensatory approaches to memory impairment seek to bypass the deficit area and teach the individual how to use certain strategies to solve functional problems (Ben-Yishay & Diller, 1993). With mastery of compensatory strategies and the use of memory aids, this approach assumes that the individual will be able to manage in their everyday environment despite the presence of the underlying impairment. Akin to the error reduction techniques described above, the use of a compensatory approach to memory rehabilitation can be understood as utilising other intact neural systems to maintain adequate memory function in daily activities. External memory aids are the most effective and widely used intervention for the rehabilitation of memory impairments (Sohlberg, 2005; Sohlberg et al., 2007). An external memory aid is a tool or device that ‘either limits the demands on the person’s impaired ability or transforms the task or environment such that it matches the client’s abilities’ (Sohlberg, 2005, pp.51). Use of at least six compensatory memory aids has been associated with increased independence, as defined by being in paid employment, full time education, living
alone or taking a major role in running the household/caring for children (Wilson & Watson, 1996; Evans et al., 2003). A large variety of memory aids have been described in the literature, with varying degrees of technical complexity. The following review of the efficacy of memory aids in the rehabilitation of memory impairment will thus consider first ‘low technology’ aids and then ‘high technology’ aids.

1.2 Low Technology Memory Aids

In a review of memory aid use among people with memory problems secondary to brain injury, the use of ‘low tech’, stationery-based aids including notebooks, diaries and calendars was most commonly reported (Evans et al., 2003). Similarly, a sample of community-dwelling older people reported commonly using paper notes, a calendar and phone/address book to support their everyday memory function (Cohen-Mansfield et al., 2005).

1.2.1 Memory Notebooks

The use of memory notebooks has been extensively studied and one of the first systematic descriptions of how to teach individuals with severe memory impairments to use a compensatory memory book was outlined by Sohlberg and Mateer (1989). A young man with a severe traumatic brain injury was successfully trained in the use of a memory notebook to allow him to progress to independent living and supported employment. The training program consisted of three stages. During the initial acquisition phase, the subject was familiarised with each section of the notebook (orientation, memory log, calendar, things to do, transportation) through directed questioning. He was also encouraged to write in his memory log and refer to the calendar for session times. During the application phase, the subject learnt when and where to use the notebook through the use of role plays. The level of cueing required to write in the memory log was also noted. In the final adaptation phase, 16 weeks after training commenced, community tasks were attempted to demonstrate the subject’s ability to adapt and modify use of the memory aid to accommodate novel situations. Positive treatment effects were evident in the context of minimal change on standardised tests of memory function.
Training in the use of notebooks has also been successfully applied to the paediatric population. Kerns and Thompson (1998) applied Sohlberg and Mateer’s (1989) training model in a case study of a 13 year-old school girl J.L. She experienced memory impairment following surgical treatment of an astrocytoma in the region of the optic chiasm and hypothalamus, with recovery complicated by hydrocephalus. J.L. was initially trained in the use of a compensatory memory notebook with the use of questions and error-reduction techniques to familiarise her with notebook sections. Role plays were used to apply this knowledge to her school routine. However, adaptation of the notebook proved difficult as she did not know what information to record. Thus the notebook was replaced with a daily re-usable checklist, personalised to classroom activities and homework. With training in the notebook and use of the abridged checklist, J.L. was able to remain at school. Her teachers reported improvement in her everyday memory function and self-esteem.

Memory notebooks may be individually customised for a client or purchased off the shelf to meet an individual’s everyday needs. Wilson and Hughes (1997) describe the evolution of a system of external memory aids by J, a young man who had sustained a subarachnoid haemorrhage. He initially used a system of a watch alarm and a notebook to remind him to write down what he was doing. A Dictaphone was also used to record on-going events. However, his memory system evolved to include a Filofax that was customised to his needs, supplemented with the use of Post it notes, a Dictaphone and watch alarms. The Filofax was customised to include a page-a-day diary, colour coded lists and fact sheets containing information about people in his life or jobs (to support his work as a French polisher). J states that the colour coded lists facilitated cross referencing of the information, several sheets at a time (Wilson & Hughes, 1997). He noted that the portability of the Filofax is an advantage.

Squires et al (1996) report the single-case study of training a man with severe anterograde amnesia to use a memory notebook. Following two strokes, the client presented with severe repetitive questioning and increase reliance upon his wife for everyday information. Training involved two stages- the initial stage familiarised the client to use the notebook for information he could not remember by using the notebook to train associations between pairs of pictures. Once use of the notebook to access information was achieved, his wife made diary entries containing information
about daily and recent events. The client was then asked a number of questions under errorless learning conditions and told to refer to his notebook for the answers. There was a significant reduction in the number of repetitive questions for the specific information listed in the notebook.

Memory notebooks and diaries can successfully compensate for a variety of functional tasks, including circumventing impairments in prospective memory- the ability to remember to carry out an action at a specific time in the future. A distinction has been made between event based prospective tasks (post the letter when you see a post box), time based tasks (take your medication at 10am) or activity based tasks (take your medication after brushing your teeth). It has been suggested that compensatory aids support prospective memory by both transforming event based tasks into time based prospective tasks (Jeong & Cranney, 2009) before then triggering the intention that something has to be done and retrieving the content of what has to be done (Fleming et al., 2005). Memory aids can also support general prospective goals, such as a completing a task at some time in the future, in addition to specific tasks that need to be completed at a set time (Fish et al, 2010). Use of memory notebooks improved preparation of prospective memory homework assignments in a group of four people with traumatic brain injury (Zenicus et al., 1991). Treatment involved modelling prompts to schedule appointments. After treatment, subjects were more compliant with assigned homework and attendance of future appointments. Fluharty and Priddy (1993) successfully trained a client with a traumatic brain injury to use a memory book to remember items such as upcoming events, his medication regime and things to do. Consistent use of the notebook was facilitated by framing the use of a notebook as a socially accepted and widely used form of memory support and focusing on tasks that were meaningful for the subject.

In an attempt to bring together recommendations on how to train the use of memory aids, Kime (2006) has proposed a systematic approach which incorporates development of a memory aid system based on the client’s individual needs, matching a number of memory aids to those needs and establishing a reflective learning cycle to implement use of the aids. Key features of the effective use of a notebook include consulting the notebook at predefined times, keeping it in possession at all times, making notes, marking completed tasks, retrieving information and using the
calendar. Training the use of a compensatory notebook within this learning cycle is described by Prigatano and Kime (2003). The starting point for training is the identification of treatment goals; current aids and recommendations regarding which notebook to purchase. The notebook was then customised to address personal goals, and use of the notebook was trained with demonstration, errorless learning techniques, and in session exercises. Generalization was facilitated by training at home or work, in the environment where the notebook was to be used. Following training, clients reported increased productivity, reduced confusion and feeling more organised. Kime’s system (2006) addresses additional ‘low technology’ aids that are commonly used by people with acquired brain injury (Evans et al, 2003) including personalised forms, checklists, placards and dry wipe message boards. She advocates the use of a system of memory aids to address personal goals, including the use of a wrist watch alarm to cue the client to refer to their notebook. Indeed, Kime, Lamb and Wilson (1996) successfully trained a woman with a dense amnesia to use a notebook with the aid of a watch alarm that cued her to refer to her notebook on an hourly basis, similar to J as described above (Wilson & Hughes, 1997).

### 1.2.2 Memory notebooks and awareness training

Ideally, use of a compensatory memory aid requires that the individual acknowledge that they have memory problems so that they can then select and use the appropriate memory aid and anticipate problem areas where support may be required. Increased awareness of memory difficulties and their impact may facilitate greater acceptance of memory aid use and reduce abandonment in the long term. Schmitter-Edgecombe and colleagues (1995) extended Sohlberg and Mateer’s training program to include an anticipation phase prior to training in the core components of the memory book. This additional phase was intended to develop awareness into memory impairments and the need for using an external aid. Treatment consisted of didactic lessons and homework assignments to use the notebooks for learning names. After instruction in the components of the notebook, participants were trained to apply these sections to remember daily activities, maintain appointments and to make notes. Finally, in the adaptation phase, training focussed on the use of the notebook as an aid to time management and personal goal setting. Training in the use of the notebook was more effective in reducing everyday memory failures in a group of people with severe traumatic brain injuries than a supportive therapy group. The positive effects of
training were maintained at six month follow-up. This program of anticipation, acquisition, application and adaptation was subsequently used to train five individuals with very mild dementia to use memory notebooks (Schmitter-Edgcombe et al, 2008). Training included the use of an alarm to cue use of the notebook. Following training, subjects reported increase use of the notebooks; however, this was not accompanied by objective evidence of reduced frequency of everyday memory lapses.

To address the potential barrier of poor awareness of memory deficits, Burke and colleagues (1994) presented a collaborative process approach to train a young man with a traumatic brain injury in the use of a memory book. The need for a memory notebook was driven by the client, who worked alongside the professional acting as a coach to identify the best way of storing and retrieving information. Emphasis was placed on the client’s choice of the notebook features and modification of features to suit the client’s needs. To develop awareness, prior to training, reality testing of functional memory was conducted to facilitate awareness of the impact of memory problems in everyday life. Training involved use of personally and socially relevant examples, review of notebook features, how to make effective notes and structured referencing of the book. Generalisation was facilitated by use of the notebook in the client’s environment with family and friends acting as co-therapists.

As another alternative to Sohlberg and Mateer’s (1989) training protocol, Donaghy and Williams (1998) advocate a training protocol for people with severe memory impairments. The aim is to train a ‘Memory Journal’ which will allow the individual to both track future events and to make detailed records of past events. A personalised journal is developed with one page for future events and the other to log events that occur during the day. The authors state that the advantage of such a journal is that clients do not have to search between diary sections for information. Additional sections allow planning for events up to one year in advance and storage of past logs. The journal is trained with the use of mnemonics, role plays and establishment of a routine to facilitate independent journal use. Donaghy and Williams note that such a memory aid, whilst useful for people with severe memory problems, is only recommended for those with awareness of their difficulties.
Fleming and colleagues (2005) also incorporated awareness training into a program training the use of a diary or electronic aid to address prospective memory difficulties. Self-awareness training was conducted prior to the introduction of the memory aid and included reality testing activities to gain experiential feedback and discussion of realistic goals for the program. Self-estimation of performance was conducted before and after activities. Clients were also given feedback on their performance throughout the program. Fleming and colleagues encouraged generalisation through the use of skills practice in real life scenarios presented in video format, such as remembering social engagements or to pay a bill, and homework supported by family members. Three clients with traumatic brain injury were successfully trained to use a diary or electronic diary to remember daily events, success which was maintained across a two month period.

Onsworth and McFarland (1999) compared standard task specific training in the use of a diary with ‘top down’ training which emphasized the subject’s ability to self-regulate use of the diary. Training included provision of a strategy to mediate diary use which focussed on task identification, selection and monitoring. Subjects who had received self-instructional training made more consistent diary entries than those who received standard diary training. The former also reported a lower level of memory difficulties, less confusion and rated the strategies as more helpful. The authors concluded that provision of self-instructional training may have facilitated generalisation of notebook as subjects were able to apply the compensatory strategy across a range of situations.

Adopting the use of a compensatory memory diary and self-interaction training, Ho and colleagues (2011) aimed to improve the everyday memory function and mood of children with acquired brain injury (aged 11 to 17 years). Using a diary, the children were trained according to Sohlberg and Mateer’s (1989) approach as described previously. Treatment comprised six 1.5 hour sessions delivered over consecutive weeks. In addition they were taught to use the internal strategy encouraged by Onsworth and MacFarland (1999) of task analysis, strategy selection, initiation and monitoring which encouraged subjects to think of memory as a problem to be solved. Following treatment there was a significant increase in the number of diary entries, in addition to subjective improvements in everyday memory.
In a more detailed examination of the successful components of prospective memory rehabilitation, Shum and colleagues (2011) conducted a randomised controlled trial of self-awareness training and diary use in a sample of people with moderate to severe traumatic brain injury (n=45). The number of diary entries relevant to personal prospective memory tasks was taken as a measure of strategy use in real life. Subjects received self-awareness training which focussed on self-prediction of performance and self-monitoring, diary training or corresponding control modules of either supportive sessions or remedial memory training. The intervention was relatively brief across eight sessions of 1.5 to two hours per week. Results supported the use of specific training in the use of the memory diary with transfer of effects into everyday life and on a standardised measure of prospective memory. There was, however, no effect of self-awareness training alone on prospective memory function.

### 1.3 High Technology Memory Aids

Whilst low technology, stationery based memory aids have been widely available for many decades, there is a rapidly growing market of high technology, electronic memory aids. Examples of high technology aids include timers, calendars operated on a personal computer, personal data assistants (PDAs), smart phones, voice recorders, watches with alarms and paging devices (see Herrmann et al., 1999; Kapur et al., 2004). Given that many everyday memory difficulties in both brain injured and non-neurological populations are prospective memory difficulties with problems remembering to carry out future intentions (Fish et al., 2010), electronic memory aids have the potential to remind the user not only of what they have to do, but when they have to do it. In this way, the alarm on an electronic memory aid transforms the task from a time-based prospective memory task to an event based task. However, although electronic memory aids are available, these devices may not be readily adopted due to cost and may be difficult for people with cognitive impairments to use. This latter point is particularly pertinent with respect to the development of training modules since the upgrading of some electronic memory aids such as smart phones occurs rapidly with the potential to render training packages and research findings obsolete.
1.3.1 Neuropage

The most compelling evidence for the rehabilitation of (prospective) memory function with the use of compensatory memory aids comes from a series of studies using an alpha-numeric paging system to target specific everyday functional goals. The Neuropage system (Wilson et al., 1997; Wilson et al., 2003; Martin-Saez et al., 2011) has been shown to assist people with memory and planning problems following acquired brain injury to carry out everyday tasks. After selection of target behaviours such as remembering to take medication or attendance at appointments, participants were provided with a pager and then sent reminders for these behaviours at times agreed with the participant and their carer. With a sample of 143 participants, use of the pager significantly increased performance of target behaviours relative to baseline (Wilson et al., 1997; Wilson et al., 2003).

The use of the pager has been examined with respect to participant’s aetiology, with successful use in participants with traumatic brain injury (Wilson et al., 2005), encephalitis (Emslie et al., 2007) and cerebrovascular disease (Fish et al., 2008). Neuropage has also been successfully used in a group of children and adolescents (Wilson et al., 2009). A recent review of the Neuropage service considered use of the device alongside growing accessibility to mobile and smart phone technology (Martin-Saez et al., 2011). The authors concluded that the paging service continued to have a role within cognitive rehabilitation as either a long term cognitive prosthetic for people with more severe cognitive and behavioural problems or as a tool to assist people to use technology to foster independence early in their rehabilitation.

Neuropage has been used to specifically compensate for the impact of executive dysfunction on everyday behaviours in a woman recovering from stroke (Evans at el., 1998). A review of this case study (Fish et al., 2008) confirmed the utility of specific goal-related messages in addition to a more general prompt to review activities. Neuropage is purported to support memory by provision of information about what a client has to do in addition to provision of an alert which acts to focus attention and assist goal review (Fish et al., 2008). Indeed, individuals with both memory and executive dysfunction may benefit from additional executive strategy training in combination with use of the paging system (Fish et al., 2008).
1.3.2 Voice Recorders
Another form of electronic memory aid is a portable Dictaphone type device which can replay messages at a time and date specified by the user. Van den Broek and colleagues (2000) used an IQ Voice Recorder which alerted the user to play a previously recorded message with an auditory alert at a specified time and date. Prospective memory for everyday tasks, including passing a message to a carer, was improved for a group of five people with brain injury. A similar recording device, a Sony IC Recorder, was used to record therapy tasks such as completing a diary in group of patients following stroke or TBI (Yasuda et al., 2002). Experimenter-recorded messages were heralded at a set time by an alarm and resulted in increased completion of targeted daily tasks. Oriani and colleagues (2003) successfully used a voice recorder to improve completion of everyday prospective memory tasks in a group of people with mild to moderate dementia. The voice recorder was shown to be superior to written reminders and patients were provided with specific training in the use of the memory aid.

Voice recorders have been used with varying success to support medication adherence. In another study, use of a Voice Craft voice recorder in combination with written reminders was investigated to address medication compliance in an individual with significant memory and executive impairments following TBI (Van Hulle & Hux, 2006). Use of the voice recorder was not successful, possibly due to poor motivation to increase independence. This patient also did not benefit from the use of a Watchminder, a wristwatch alarm with written prompt, in contrast to another subject who was able to use this memory aid to independently manage his medication regime. In contrast, voice prompts have also been effective in increasing medication adherence in a sample of HIV infected subjects with memory impairment (Andrade et al., 2001). The Disease Management Assistance System was programmed to sound an alert and play a message when a dose of medication was due, and a record was kept of the time and date when the medication was taken.

1.3.3 Electronic Organisers
An early study into the use of a portable electronic organiser was conducted by Giles and Shore (1989). A Psion organiser was found to be superior to a paper-based organiser to facilitate completion of everyday tasks for a woman recovering from a
subarachnoid haemorrhage. The organiser had an electronic diary function with an alarm in addition to a ‘memo pad’ command for storing miscellaneous information. This type of organiser was also found to effective in executing everyday prospective memory tasks in a mixed neurological sample (Kim et al., 2000), possibly through improved time management as a result of visual and auditory cues.

PDAs containing a diary, notebook and a to-do-list were found to be useful by a group of people with acquired brain injury (Wright et al., 2001). PDA use was also found to be superior to written lists or a paper based planner in a group of students with traumatic brain injury (Gilette & De Pompei, 2008). Interestingly, the students were not required to enter details of the experimental prospective memory tasks, only to familiarise themselves with the device. Gentry and colleagues (2008) investigated the use of an off-the-shelf PALM PDA as a cognitive aid in a group of people with traumatic brain injury. Training was provided in how to use the calendar, alarm, appointments and tasks (‘to do’) functions on the PDA. Following two months of use, participants reported improved performance and satisfaction with performance in everyday tasks in addition to increased levels of participation in areas of cognition, mobility and occupation (Gentry et al., 2008). More recently, Dowds and colleagues (2011) compared the effectiveness of a paper based memory aid to PDA/palm top memory aids in 36 subjects with traumatic brain injury. Participants were given an experimental prospective memory task and three personal tasks to complete using the low or high technology memory aid. Although the exact training was not specified, use of an electronic memory aid with an alarm increased the rate of timely task completion in survivors of TBI with self-reported memory problems.

1.3.4 Mobile Phones and Smart Technology
Mobile phones are increasingly attractive as ‘high tech’ memory aids as their use is ubiquitous in the non-neurologically injured population. Mobile phones also have the advantage of being portable, potentially cost effective and more socially acceptable. Mobile phones were initially used as reminding devices in rehabilitation, with evaluation of the use of SMS text messages to prompt execution of prospective tasks. An early study into the use of a ‘standard’ mobile phone incorporated a reminder message sent to the participant’s phone to act as a memory prompt for completion of everyday tasks. Compared to self-initiated performance, reminders sent to a mobile
phone increased initiation of everyday tasks such as taking medication or self-care tasks (Wade & Troy, 2001) addressing difficulties in memory, planning and organisation. Stapleton and colleagues (2007) provided mobile phones programmed with individualised messages using a reminder function. Written reminder messages appeared on the phone in conjunction with an auditory tone at a specified time and date. However, use of these mobile phone reminders was not successful in increasing performance of target behaviours in subjects with severe memory impairments (Stapleton et al., 2007).

SMS text messages facilitated recall of rehabilitation therapy goals (Culley & Evans, 2010), with a general alerting effect that generalised to other non-targeted therapy goals. Similarly, participants with organisational problems following acquired brain injury were sent randomly timed text messages to prompt goal review and improve prospective memory function (Fish et al., 2007). The messages were a mnemonic form of brief goal management training and served to enhance general prospective memory function. Pijnenborg and colleagues (2010) demonstrated that short text messages increase achievement of personally selected everyday goals in a sample of people with schizophrenia. The treatment effect was dependent on continuous use of the mobile phone and more pronounced in subjects with more severe impairments at baseline.

The advent of ‘smart phone’ technology has provided an electronic memory aid which encompasses PDA capabilities within a mobile phone. Smart phones, utilising built-in reminders, were more effective in facilitating task completion compared to a paper-based planner for adolescents and adults with traumatic brain injury (DePompei et al., 2008). The authors suggested that the audible reminder may have accounted for the success of the smart phone not only for specific tasks but to prompt use of the memory aid itself – ‘use your reminder’. The most common functions used by subjects were organisational and communication tools such as the calendar, contacts, and task lists in addition to the camera and games.

The relentless advance of smart phone technology has presented a challenge to provide evidence of the effectiveness of smart phones in memory rehabilitation research. Svoboda and colleagues (2012) have developed a theoretical based training
program to support people with moderate to severe memory problems to use smart phones and PDAs. Based upon Sohlberg and Mateer’s (1989) model of memory compensation training, the authors suggest that the training approach can be applied to any number of emerging technologies. Training is comprised of two phases: acquisition of skills to use the calendar function of the smart phone or PDA and then real life generalisation. Training continued until skill acquisition and generalisation were successful rather than after a set number of sessions (Svoboda et al., 2012). Ten subjects with acquired memory disorders demonstrated improved day-to-day memory function following training. These subjects included two cases that had been previously described- one subject with amnesia following removal of a colloid cyst (Svoboda & Richards, 2009), the other with a severe memory impairment following treatment of a suprasellar germinoma at the age of 13 (Svoboda et al, 2010).

Navigational assistance for people with cognitive impairments is available through smart phone technology with tools such as Global Positioning Systems (GPS) or software applications such as Google Maps. There are also widely available portable satellite navigation systems for use when driving. Utilising a PDA navigational device, Sohlberg and colleagues (2007) demonstrated that people with TBI performed better on a navigational task when given directions in the auditory modality as opposed to text, maps or pictorial information. In addition, further research into navigational skills in TBI suggested that landmark directions were used most effectively (Limoncello et al., 2010). At present, landmark information and auditory only prompts are not ubiquitous on navigational aids, although growing availability of Geographic Information Systems (for example Google Street View) which capture environmental features may provide this information in future models of navigational aids. ‘Opportunity knocks’ is an example of a PDA based intelligent navigational aid which, over time, learns frequent routes and destinations to support memory through pictures or text (Boger & Milhaidis, 2011). The device also uses GPS and information about public transport routes to guide the user to his or her destination.

Recent developments in mobile phone technology include platforms for the optimal use of Windows applications, email, web browsing, GPS maps and adoption of so called ‘third generation’ applications (or ‘apps’). Whilst apps are available for ‘brain training’ and memory training drills, as noted above there is little evidence to support
the use of repetitive drills in the rehabilitation of everyday memory problems (see Wilson, 2009). Rather, it is the (rapid) development of ‘apps’ that act as a support to everyday memory function that holds the most promise for use with people with memory and other cognitive impairments following acquired brain injury. These include ‘apps’ which act as reminders on the basis of both time and location, supports to locate personal belongings, take medication, academic study supports or organisational programs which provide voice prompts to initiate everyday tasks. The challenge for the clinician is the development of a methodology for training the use of the smart phone and associated ‘apps’ in addition to keeping up to date with these rapid technological developments. In this respect, Svoboda and colleagues’ training program (2009, 2010) described above is an exciting development particularly given its success with subjects with severe memory impairments. Similarly, a manual has been produced for use of an IPod Touch, iPhone or iPad as a memory/cognitive prosthetic device following acquired brain injury (Wild, 2009; 2011; see www.id4theweb.com). The program, based upon a training program for a Windows-based mobile device (Wild & Schwartz, 2009), systematically trains the specific skills required to use these smart devices, whilst attempting to generalise these skills to other real-world tasks.

To overcome the cost associated with the use of technological memory aids, McDonald and colleagues (2011) conducted a randomised controlled trial of Google Calendar, an electronic calendar available free of charge on the Internet with the advantage that timed text reminders can be sent directly to a client’s mobile phone. The calendar is easy to use as it only requires events to be entered into the calendar, noting the date and time the reminder is required and selecting the reminder message. Subjects with an acquired brain injury were required to use weekly record charts to monitor completion of prospective memory tasks. Compared to standard diary use, Google calendar was shown to be significantly more effective than a paper based diary in supporting subjects’ prospective intentions (McDonald et al., 2011). The results were interpreted as positive support for the use of this technology for people with acquired memory and executive disorders and in support of active reminders over passive reminders, such as paper based diaries, calendars or notes.
Technology allows for novel approaches to support independent living and compensate for memory problems within an individual’s environment. Limoncello and colleagues (2011) conducted a randomised controlled trial of Television Assisted Prompting (TAP). This system consisted of a set top box positioned close to the client’s home television with which they interact using their remote control. The TAP system turns on the television at any time to deliver reminders that have been programmed remotely from a computer. Compared to brain injured clients typical memory prompts, the TAP system allowed completion of a greater number of tasks and improved confidence (Limoncello et al., 2011). Task completion improved from 43 percent during the typical reminder period to 72% task completion with the support of the TAP system.

1.3.5 Software

O’Neill and colleagues (2010) distinguish between scheduling support, which provide reminders to perform tasks, and sequencing support, which form an expert system to guide performance in everyday tasks. The use of smart phones as a compensatory memory aid is an example of a scheduling assistive technology device. A number of software packages have been developed to minimise the cognitive challenges presented in specific everyday tasks and provide interactive ‘scaffolding’ to compensate for memory or executive impairments (Cole, 1999, LoPresti et al, 2004). These include the Planning and Execution Assistant and Training System (PEAT, see Levinson, 1997) which generates the best plan to complete steps required in a task with the support of visual and auditory cues and COACH (Cognitive Orthosis for Assisting aCTivities at Home, Boger & Mihailidis, 2011) which has been used to support people with dementia to complete hand washing independently. More recently, commercial products such as Pocket Coach provided by AbleLink (Gentry et al, 2008) create a step-by-step sequence of visual cues on a desktop computer which are then loaded onto a PDA to aid task completion. Similarly, use of ICue (LoPresti et al, 2008), an interactive software program presented on a PDA, reduced the number of errors in everyday tasks in two subjects with acquired brain injury by the provision of visual/graphic cues in addition to written text. O’Neill and colleagues (2010) describe a verbal prompting system, GUIDE, which improved performance when donning a prosthetic limb in a group of patients with peripheral vascular disease and associated memory impairment. Future developments of these cognitive support systems include
the ability to recognise different situations and adapt to the individual’s needs. For example, a context aware medication reminding program that waits until the individual is not otherwise engaged to prompt medication use (Boger & Mihailidis, 2011).

### 1.3.6 Other Technologies

One platform which brings together a number of emerging technologies is the ‘Smart Home’, a living environment constructed to assist people with disabilities carry out everyday activities by using various integrated assistive technology systems (Dewsbury & Linskell, 2011). For example, electrical equipment may be extinguished automatically or sensors installed to monitor wandering. Boman and colleagues (2007) trained eight people with memory impairments secondary to traumatic brain injury or stroke in the use of a number of electronic aids. These included electronic keys, a stove guard, a remote control which activated lights and power to kitchen equipment and a laptop with email alerts and an electronic calendar. Training was conducted in situ and consisted of breaking each task into a sequence of steps, then training each step with errorless learning principles. In a similar smart house apartment, Boman and colleagues (2010) instructed 14 subjects with moderate memory impairments following traumatic brain injury or stroke to use a number of electronic memory aids. Memory aids included a daily computer based schedule, equipment control panels and kitchen alarms. Following intensive in situ training based upon the principles of errorless learning, the group generally learnt how to use the memory aids (Boman et al., 2010). The authors reflected that performance was enhanced by specific training (e.g. the television remote control) as opposed to stimulus-response learning for feedback alarms (such as the stove alarm). Dewsbury & Linskell, 2011) have suggested a neurological dependability assessment matrix to facilitate the technological-fit of smart house technology to the needs and wishes of the individual with the neurological condition.

An emerging compensatory aid for support of autobiographical memory is the use of a wearable camera which passively records images throughout the day, automatically or during selected events (Hodges et al., 2011). The images are then reviewed as a pictorial diary at a later time, akin to watching a movie or the event or day. Developed by Microsoft under the brand name SenseCam, this technology is now been made
commercially available as Autographer (www.autographer.com). In an initial case study of a woman recovering from limbic encephalitis, recall of autobiographical events with SenseCam with a delay of one day was superior to the use of a written diary (Berry et al., 2007). Recall was maintained across a delay of 11 months. It is suggested that with this case, SenseCam images functioned to facilitate consolidation of episodes into long-term memory by promoting activation of frontal and posterior cortical regions (Berry et al., 2009). Alternatively, SenseCam may facilitate recall of otherwise inaccessible episodic memories through the capture of images from the perspective of the individual and the temporal ordering of images (Loveday & Conway, 2011). With the presentation of a large number of images and thus a wide range of related but changing visual cues, SenseCam also increases the likelihood that the record of the event contains an effective cue.

SenseCam has shown promise in a cognitive behavioural therapeutic intervention in a young man experiencing social anxiety subsequent to a TBI (Brindley et al., 2010). The device appeared to support retrieval of personally salient anxiety provoking events with reference to internal states. Sensecam also increased the long term retention of specific episodes in a 13 year old boy with anterograde amnesia secondary to a brain tumour treated with radio and chemotherapy (Pauly-Takas et al., 2010). It was suggested that review of the SenseCam images facilitated the formation of personal semantic memories. Future developments in the use of wearable memory prostheses include context-aware memory devices (LoPresti et al., 2004) to extend location-based reminders to include information such as person identification and additional semantic information about social environments (see Vemuri & Bender, 2004; Kkhia et al., 2009).

1.4 Efficacy of memory aids in the cognitive rehabilitation of people with Mild Cognitive Impairment (MCI) and Dementia

Dementia is generally used to refer to a neurodegenerative syndrome characterised by impairments in higher-order cognitive functions sufficient enough to interfere with everyday function. It is more prevalent with increased age and is a feature of a number of progressive neurological conditions including vascular dementia and, most commonly, Alzheimer’s disease (AD). Memory impairment is one of the key features
of AD and occurs in other progressive neurological conditions of old age to varying degrees. A number of older adults who are seen in outpatient memory clinics present with difficulties that are rather more marked than the norm but do not impact significantly upon everyday functioning. These individuals who do not meet the criteria for a diagnosis of AD are often described as having Mild Cognitive Impairment (MCI; Petersen, 2004). People with MCI are at increased risk of developing dementia, with progression to AD reported at a rate of 12-15 percent per year as opposed to 1-2 percent in healthy adults (Petersen et al., 1999). The impact of dementia on everyday functioning can bring with it a loss of self-confidence associated with low mood and anxiety, in addition to a growing burden on families and other systems of care (Clare & Woods, 2007). With an ageing population and the concomitant increasing prevalence of dementia, interest in the management of dementia is growing. At present, there is no cure for dementia although some pharmacological treatment is available for some patients to delay the inevitable progress of the disease (see National institute for Health and Clinical Excellence, 2011). Treatment focus has turned to the management of the effects of dementia to maintain quality of life for people with dementia and their families.

Clare (2008) has conceptualised dementia within a biopsychosocial model with consideration of the physical health of the individual, the neuropsychological behavioural and emotional impact of dementia, and the experience of the individual with dementia in his/her social network and society in large. This model encourages dementia to be viewed in terms of disability and participation (WHO, 2001) and in turn helps to define intervention approaches. Since neuropsychological changes are central to a diagnosis of dementia, management of these changes has an important role in supporting people with dementia (Clare, 2008). Cognitive retraining programs have often been used to manage the cognitive impairments associated with dementia. This typically involves guided practice on a set of standard tasks designed to reflect particular cognitive processes such as memory, attention, executive function, etc. (Clare & Woods, 2003). However, limitations of cognitive training include poor generalisation from the training task to the individual’s environment, inclusion of neuropsychological tests as outcome measures and use of generic programs that cannot be adapted to individual needs (Clare et al., 2009; Clare & Woods, 2003; Clare, 2008).
In contrast, neuropsychological rehabilitation adopts a more individualised approach to the management of cognitive impairments associated with dementia. As noted previously, rehabilitation can be defined as the use of any strategy or technique that enables people with brain injury to bypass or reduce cognitive deficits in order to function as adequately as possible in an environment that is most appropriate to them (Wilson & Evans, 2003). The focus is on reducing disability and increasing participation, as opposed to removing the underlying impairment. Understanding of the cognitive, or more specifically the memory profile in MCI, early AD and other dementias lends support for the use of neuropsychological rehabilitation techniques. By definition, amnestic MCI is associated with otherwise intact general cognitive function (Petersen, 2004), intact abilities which may be utilised to compensate for memory impairment. In early AD and generalised cerebrovascular disease, the episodic memory system is typically impaired (Clare & Woods, 2003). Knowledge of strengths and weaknesses within memory systems in addition to an understanding of other intact cognitive abilities can also facilitate the development of a rehabilitation approach based on compensatory strategies and memory aids. As noted, there is a rich history of the use of cognitive rehabilitation for acquired brain injury, including the use of compensatory memory aids to manage acquired memory problems. The application of these techniques for people with MCI and early stage dementia is now being explored; with the potential that introduction of techniques within these early stages may slow the rate of decline (Troyer et al., 2008) and at least maintain functional skills in everyday activities.

1.4.1 Cognitive Rehabilitation for people with dementia or MCI

Patients with early stage dementia are able to benefit from cognitive rehabilitation, including the use of memory aids. Graff et al (2006) conducted a single blind randomised controlled trial (RCT) on the efficacy of home based occupational therapy sessions relative to a waiting list control group. Intervention sessions consisted of goal setting, the development of compensatory and environmental strategies, and the application of these strategies to everyday activities. Following the intervention, the daily functioning of people with dementia improved and the carer burden was reduced. These gains were maintained at a 12 week follow-up. In a direct comparison
of mental stimulation training and use of cognitive rehabilitation in early stage dementia, Loewenstein and colleagues (2004) demonstrated a greater benefit of rehabilitation techniques including name/face associations, use of a calendar and notebook, and practising everyday tasks (making change for a purchase). Outcome was measured by orientation, face-name learning, speed of processing and mock everyday task performance. Similarly, Avila et al., (2004) showed that patients with early AD were able to benefit from memory training (motor movements, categorisation and verbal associations) and training in everyday activities with significant improvement on a laboratory test of everyday functions including telephone use, taking messages, diary use and preparation of a sandwich. Generalisation to activities of daily living was not reported.

Cognitive rehabilitation was shown to be superior to relaxation training or a waiting-list control for people in early stage AD (Clare et al., 2010). The rehabilitation program involved eight weekly one hour sessions of individualised intervention to address personal goals. Components included practical aids and strategies, face name learning, and stress management. Specifically, subjects in the intervention group were better able to attain personal goals relating to everyday tasks such as remembering details of jobs to be done around the house, learning to use a mobile phone or remembering names of new people. Subjects with a carer involved in the intervention showed a larger increase in performance than those who did not (Clare et al., 2010).

There is also growing evidence for the efficacy of cognitive rehabilitation in MCI. Troyer and colleagues (2008) compared the performance of 68 participants with MCI with a waiting-list control group to evaluate the effectiveness of a ten-session group intervention which focussed on changes in memory-related everyday behaviours to maintain functionality. Sessions were structured to include presentation of information, focused memory intervention training, review of the session and outcome testing. Homework assignments were set across the program, which included practice using a memory book, which consisted of a calendar, to do list, frequently used telephone numbers and a blank ‘scratch’ pad. Interestingly, knowledge of memory strategies was assessed using presentation of hypothetical memory situations in addition to other components of memory questionnaires previously designed by this research group (see Troyer, 2001). Subjects in the intervention group showed
better knowledge and use of memory strategies in their everyday life compared to controls, with maintenance of treatment gains at three months. Kinsella and colleagues (2009) also conducted a RCT to evaluate the impact of a five-week memory group intervention with MCI subjects, using a waiting list control group. Treatment included exploration of the use of memory aids for a variety of everyday situations, general coping strategies and education about memory functions in general and about memory strategies, in particular name-face learning and visual imagery. Treatment was associated with improved performance on prospective memory tasks and increased awareness of memory strategies (Kinsella et al., 2009).

Kurz et al (2009) compared the outcome of subjects with MCI or mild dementia to a waiting-list control group following a four week cognitive rehabilitation program. The program had a wide range of content, including regular use of notebooks and time planners, and use of external memory aids. Performance on Activities of Daily Living (ADL) had increased for subjects in the treatment group. However, this study is somewhat limited by reliance on neuropsychological tests as other measures of outcome, the lack of follow-up and a brief period of treatment. Londos et al (2008) adopted a goal-oriented cognitive rehabilitation program for 15 participants with MCI. The group training program consisted of education about memory, training in the use of compensatory techniques including memory aids, and planning new methods to perform activities. Following treatment, participants rated their occupational performance and satisfaction as higher and these gains were maintained at a six-month follow-up. The lack of control group in this study was noted by the authors. Finally, Clare and colleagues (2009) describe the single case study of AB, a 77 year old woman with MCI, who participated in eight weekly sessions of a goal-oriented cognitive rehabilitation program. The intervention included use of memory aids, including a diary, a to-do list within her diary, a tape recorder and her monthly calendar. Following intervention, AB showed improved performance on her individualised goals and neuroimaging showed increased activation in the left inferior and middle frontal gyrus during encoding and in the right inferior frontal gyrus and right temporo-parietal junction during recognition (Clare et al., 2009).
1.4.2 Memory Aids and MCI
The use of memory aids for people with dementia or MCI has also been adopted from the acquired brain injury literature. Similar considerations regarding the match between the features of the memory aid and the individual’s needs and characteristics must be taken into account. The increased age, severity of memory impairment and probable presence of other cognitive impairments initially argues against people with dementia as good candidates for the use of memory aids (see Wilson & Watson, 1996; Evans et al., 2003). To overcome these potential barriers, people with dementia must be carefully trained to use memory aids, utilising pre-existing knowledge and behaviours, with care giver support and appropriate learning strategies such as error reduction methods (Clare, 2008; Cahill et al., 2007). In particular, spaced retrieval has emerged as an effective technique to train people with dementia to use memory aids (Bourgeois et al., 2003) with maintenance of learning at a four-month follow up. The intervention and indeed the memory aid prescribed may need to change with time as the disease progresses and the individual’s needs and goals change. Training may need to be provided at a slower pace with adaptation of the memory aid according to the cognitive and sensory abilities of the participant. Involvement of a carer as co-therapist has been identified as a determinant of successful use of memory aids by people with dementia (Schmitter-Edgecombe et al., 2008; Clare et al., 2010), possibly because such support allows for extensive supervised practice between sessions.

Greenaway and colleagues (2008) adopted Sohlberg and Mateer’s (1989) acquisition, application and adaptation model to train the use of a memory notebook by 20 participants with MCI. Initially, participants were taught information about the sections of the notebook and to carry the book with them at all times. Regular review was paired with established daytime routines such as meal times. In the second phase of training, real-life events were entered into the notebook and finally subjects were taught how to apply the notebook to other daily activities. The authors developed specific training questions to assess knowledge, and homework assignments were given. Compliance was assessed by a review of notebook entries. The rehabilitation program demonstrated that individual’s with MCI can be trained to use a memory notebook system to support everyday memory. More recently, Greenaway and colleagues (2012) extended their examination of memory aid use with the MCI
population with a randomised controlled trial comparing a memory support system (calendar and note taking system) with a no treatment control group (calendar provided without training or encouragement). Training was again based upon the Sohlberg & Mateer (1989) model described. Following treatment participants reported improvements in functional ability and their sense of self efficacy. Improvements were not maintained at six months which the authors suggested could be circumvented with the provision of booster sessions (Greenaway et al., 2012).

In another adaptation of a notebook training program previously described for people with TBI, Schmitter-Edgecombe et al (2008) describe the training of four care dyads and one subject with ‘very mild dementia’. An anticipation phase was added to Sohlberg and Mateer’s three-stage model (see also Schmitter-Edgecombe et al., 1995 in section 1.2.2) and training included components such as education, modelling, training specific components of the notebook, homework assignments and an alarm to cue use of the notebook. Following treatment, participants and their carers reported using a greater number of memory strategies although this did not transfer to a decrease in everyday memory lapses or increased functional independence. Quittre and colleagues (2005) also adapted Sohlberg and Mateer’s (1989) training program to train a woman with early stage AD to use a memory agenda. Spaced retrieval was used to train explicit knowledge and function of the components of the agenda, followed by transfer of this learning to everyday situations. Recall of recent events, time orientation and a decrease in repetitive questioning was maintained at three months follow-up (Quittre et al., 2005), confirming the utility of memory notebooks to support the everyday functioning of people with MCI.

1.4.3 Memory Aids and Dementia
Memory books have been developed as a conversational aid in people with moderate to severe dementia (Bourgeois et al., 1993; Bourgeois, 2003; McPherson et al., 2001). A memory book presents personally relevant factual information in a written and picture format. These memory aids have been shown to increase the quality of conversation of dyads with dementia, including more on topic statements and a reduction in the conversational dominance of the partner without dementia (Bourgeois et al, 2003; McPherson et al., 2001). Nursing assistants in care homes have also been trained successfully to use memory books with people with severe dementia (MMSE
to enhance the quality of their interactions, with more initiation of conversation by the person with dementia and with greater focus of the conversation on the resident (Hoerster et al., 2001).

Other ‘low technology’ memory aids have been adopted effectively by people with early-stage dementia. Bourgeois and colleagues used memory books or memory boards to reduce repetitive questions of people with possible AD (Bourgeois et al., 1997), a particularly stressful behaviour in dementia. The intervention trained the carer to provide answers to repetitive questions with the use of a memory board or book, with specific instructions to carers on how to respond to repetitive questions. With consistent use of the memory aids and consistent prompting, repetitive questioning decreased, with gains maintained over time with increased reference to the memory aids (Bourgeois et al., 1997). Similarly, Clare et al (2000) described a case study in which a prompting and fading technique was used to teach a woman with early dementia to use a calendar and a memory board as an alternative to repetitive questioning of the carer. There was a significant reduction in repetitive questioning with evidence of generalisation to problem solving in other situations. Bier et al., (2008) also used the spaced retrieval method to successfully train a highly educated man with early AD to also refer to a calendar as opposed to repetitively asking his wife for information about the date and calls to his family. Spaced retrieval was used to train a second subject to associate an alarm with initiation of an activity (to say the rosary). Transfer of learning, however, was limited (Bier et al., 2008).

High-technology memory aids have also been used to support everyday memory function in people with dementia and the UK National Dementia Strategy recognises the role of technology in helping people with dementia remain independent for longer (Department of Health, 2009). Smart House technology (Dewsbury & Linskell, 2011; Evans et al., 2011) supports people with dementia to live independently with the use of data monitoring/alerts, environmental controls and direct verbal instructions. Evans et al (2011) describe a case study of an 85 year old woman with mild to moderate dementia who was supported to live independently in a smart house with the use of messages recorded by her daughter (e.g. ‘Mum, this is a recorded message. Could you check the cooker please?’), automatic lighting, out of bed and exit risk messaging and a cooker minding system. Lancioni at al., (2011) describe four studies where verbal
instructions for everyday tasks were recorded on a tape and triggered by a photocell that responded to specific movements made by the participant’s (e.g. picking up soap in the bathroom routine task). Subjects with mild to moderate Alzheimer’s dementia were able to complete daily tasks including a bathroom routine, dressing, making coffee and setting a table. The ENABLE project (Duff & Dolphin, 2007) examined the use of assistive technology by people with dementia and their carers. Technologies included an automatic day/night calendar, an item locator, an automatic night lamp, a gas cooker device that switched off the appliance if pans overheated, and a picture button telephone. The telephone was the only device available off the shelf; all other technologies were developed for the project. Qualitatively, positive feedback was received about the day/night calendar from both people with dementia and their carers, although people with more severe dementia appeared to experience on-going confusion about the purpose of the calendar (Cahill et al., 2007, Topo et al., 2007). Items with greater complexity and lower familiarity, for example the item locator, were not as frequently used or reported as effective (Cahill et al., 2007).

Other high technology aids to be used in the rehabilitation of people with dementia include an electronic memory aid to prompt completion of everyday tasks was shown to be superior to written reminders (Oriani et al., 2003). At a required time, an alarm rang and the subject was required to press a button which played a recorded message of what he/she is meant to do; although the exact training method was not described. ‘Low tech’ environmental support has been used to supplement the use of electronic devices which support greater independence. For example, Lekeu et al (2002) used spaced retrieval to train two participants with probable AD to use a mobile phone. The intervention consisted of pasting a card on the back of each phone describing each stage of its use and showing which keys had to be pressed. At a more basic level of environmental support, Quittre et al (2005) pasted labels on a digital day/date clock to facilitate use and decrease interference from irrelevant information. The clock was used in conjunction with a memory agenda as described previously, to help the subject choose the correct page. Preliminary investigations suggest that the wearable camera SenseCam (now commercially available as Vicon Review [www.viconrevue.com]) can support recall of autobiographical event memory in people with AD, with concomitant positive effects on confidence and mood (Browne et al., 2007).
1.5 Training the use of Memory Aids

The use of memory aids to compensate for acquired memory impairments is problematic for those people who need them most. The effective use of memory aids is a cognitively challenging task and within a client population with cognitive impairments, the use of a memory aid becomes a memory test in itself. Thus people with acquired brain injury and memory impairments require specific training in the implementation of memory aids. However, in contrast to the growing body of evidence that memory aids can be effective in compensating for acquired memory impairments, there are limited details regarding specific training procedures to implement memory aids and so improve everyday functioning. Delineation of the process of memory rehabilitation with compensatory aids is important as it will ultimately guide future research and clinical treatment and thus improve patient care.

Definition of the treatment process begins with identification of the critical components of treatment, which then leads to specification of what will be said and done during treatment and finally to development of treatment materials (Hart, 2009). Recently, attempts have been made to draw out the key training principles in memory rehabilitation with the use of memory aids (Elhardt et al., 2008; Sohlberg et al., 2007), including a theoretical basis for training (Sohlberg & Mateer, 1989; Sohlberg & Turkstra, 2011). In the following section, approaches to the implementation of memory aids will be presented followed by a consideration of factors that influence treatment outcome, including matching of the memory aid to the patient.

1.5.1 Sohlberg and Mateer's Training Model

Sohlberg and Mateer (1989) describe a systematic approach to training the use of a compensatory memory notebook, based upon principles of learning theory and aspects of memory known to be preserved in amnesic patients. Three stages of learning critical for mastering new skills were identified: acquisition, application and adaptation, with adjustments to instructional strategies across these three stages to encourage skills mastery. During the acquisition stage, the patient is in a sense learning how to perform a particular skill. For example, learning each section of a memory notebook is achieved through specific and detailed questions about the individual’s notebook (Sohlberg & Mateer, 1989). The application phase refers to learning when and where to use this new skill and this is facilitated by the use of role
plays in memory notebook training. The final stage is adaptation during which the patient is learning to adapt and modify skill use in novel situations. As also emphasised by Kime (2006), the authors argue that adaptation training must take place in naturalistic community settings. Each training stage incorporates efficiency building in which performance criteria are set and must be achieved prior to moving on to the next training level (Sohlberg & Mateer, 1989). The authors argue that training of memory-impaired patients with this theoretical learning model capitalises on intact procedural memory, since aspects of using the memory notebooks were made as routine as possible.

Sohlberg and Turkstra (2011) have further developed a theoretical basis for training practices in neurorehabilitation, including the use of external memory aids. The training approach is based upon the premise that structured environmental experience is required for the client to learn, maintain and transfer the skill to functional contexts and that the heart of systematic instruction is ‘structuring input in deliberate ways while providing multiple opportunities for repetition’ (Sohlberg & Turkstra, 2011 page 10). The authors suggest a new model of training - the PIE approach of Planning, Intervention and Outcome. The first stage of training requires careful planning to identify the key learner characteristics, to define the treatment target, specify the desired outcome and design the treatment intervention. The previous Sohlberg and Mateer (1989) model is encompassed in the following implementation phase which again includes initial skill acquisition, then mastery and generalisation of the skill (which reflects the previous application and adaptation phases of training), prior to the maintenance of treatment results. Finally there is an evaluation of the clinical training intervention.

### 1.5.2 Applications of the Sohlberg and Mateer Training Model

Svoboda and colleagues (Svoboda & Richards, 2009; Svoboda et al., 2010) have used the Sohlberg and Mateer training model to teach people with severe memory impairments to achieve prospective memory goals with the use of smart phones. As noted in paragraph 1.3.4, the authors conducted a two-stage training program consisting of a skill acquisition phase and a generalisation phase. To train skills in smart phone software each application (e.g. calendar function) was broken down into
component steps. The steps were then trained using a modified version of vanishing cues which took the form of physical and verbal prompts which were successively faded as mastery increased. Guessing was minimized in keeping with an error-reduction paradigm. When the patient achieved 98 percent correct responding, they moved onto the next stage of skill acquisition, which included role plays of day-to-day tasks. The generalisation phase encompassed use of the smart phone at home. As noted previously, the authors describe the successful training of two patients with severe memory impairment following removal of a colloid cyst (Svoboda & Richards, 2009) and treatment of an intraventricular suprasellar germinoma (Svoboda et al., 2010). Intact procedural learning networks were assumed to have supported learning in these patients with severe memory impairments. The first intervention occurred with 16 one-hour sessions over a period of eight weeks, the second included 13 sessions over a period of 13 weeks. Both training programs were self-paced.

Kerns and Thompson (1998) adopted Sohlberg and Mateer’s (1989) approach to memory notebook training to describe in detail the implementation of a memory notebook system in an adolescent who was recovering from the removal of an astrocytoma in the area of the optic chiasm and hypothalamic area, with extension into the third ventricle. Knowledge of notebook sections and use of the notebook was trained under errorless learning conditions, with a series of questions within the environment in which the notebook was to be used. Indeed, generalisation was facilitated by training within the school environment and was actively encouraged by the development of appropriate questions. Notebook use was adapted across the course of treatment in line with whether the subject needed to increase structure within the school environment. In addition to error reduction techniques, the authors cite the use of habit/routine and procedural learning as the basis for their subject’s success in using the notebook (Kerns & Thompson, 1998).

Schmitter-Edgecombe and colleagues (1995, 2008) have extended Sohlberg and Mateer’s (1989) theoretical approach for training memory aids with the addition of an anticipation stage prior to skill acquisition. Using behavioural learning principles and educational strategies throughout, the anticipation phase provided education about memory to stimulate interest in memory strategies and develop an awareness of memory weaknesses (Schmitter-Edgecombe et al., 1995; 2008). Each training phase
was made up of didactic lessons and homework assignments. Initially, this training approach was used to successfully teach a group of eight patients with traumatic brain injury to use a notebook (Schmitter-Edgecombe et al., 1995). Sixteen sessions were offered over an eight-week period. The authors note that group members, of whom only one had severely impaired memory, did not achieve the same level of mastery nor progress at the same rate. The authors subsequently used this training approach to successfully teach people with very mild dementia to use the memory notebook (Schmitter-Edgecombe et al., 2008). The techniques of modelling, education, in session activities and homework assignments were provided in 14 90 minute sessions across seven weeks.

1.5.3 Other approaches to training memory aids
Kime (2006) has also advocated a systematic approach to training the use of predominantly low technology memory aids, using error reduction and behavioural teaching techniques. The treatment program is individually customised to the patient, reflecting their needs (both treatment goals and patient characteristics) and the system of memory aids that is deemed to be best suited to their needs. Focusing on the use of a memory notebook, Kime (2006) describes a reflective learning cycle that starts with establishment of short-term treatment goals, use of the notebook to achieve those short term goals, measurement of effectiveness of use including compliance data, and a final modification phase looking at what is working and what is not before the cycle starts again. Initially, training goals are selected, the memory aid is customised for the individual (such as removal of unwanted notebook sections) and the roles of those involved in treatment are clarified. Execution of the training program requires translation of the client’s intentions to use a memory aid into practice to meet their everyday goals. Kime advocates the use of errorless learning techniques to train use of a memory aid following a task analysis of the steps required to use the memory aid or to train use of a memory aid system, such as using an alarm to reference a notebook. Direct observation of the client using the memory aid in their own environment is recommended (Prigatano & Kime, 2003). Importantly following actual use of the memory aid, the training protocol involves measurements of compliance in using the notebook. Kime (2006) outlines some of the data collection that is required, including completion of monitoring forms out of session and therapist review of the notebook in session. The purpose of collecting this data is to document the client’s progress
towards reaching a goal and to help define the focus of the treatment. Indeed, the final phase is modification of the memory aid system and treatment before the learning cycle begins again.

Other studies have used a collection of intervention techniques including error reduction methods, general behavioural approaches and cognitive interventions. For example, Boman and colleagues (2010, 2007) used errorless learning to train the use of electronic memory aids within a smart home/apartment. Instructions were broken down into a series of steps and these steps were then trained by repetition and active prevention of errors. This error reduction approach was supported with direct instruction and environmental supports including lists, written instructions and a manual. Level of cueing and degree of repetition was varied according to the participant’s individual needs (Boman et al., 2007, 2010). Prompts were provided to prevent errors during training to use mobile phones (Stapelton et al., 2007), with fading of this support over trials. Of note, the mobile phone reminders were programmed by the researcher in this study and only message retrieval was actively trained and practised.

Trial-and-error approaches to training where errors are corrected as they occur have also been used to implement memory aids. Wilson and colleagues (Wilson et al., 1989) attempted to teach people with brain injury a six-step sequence to use an electronic memory aid through demonstration, verbal instruction and trial-and-error learning. As subjects struggled to learn the sequence, the authors reflected that learning may be underpinned by episodic memory, particularly in the trial-and-error format, which was compromised in these patients. Indeed, errorless learning techniques have found to be superior to trial and error techniques for individuals with severe amnesia. However, this advantage may depend on how memory is probed at the final test (Middleton & Schwartz, 2012). When explicit recall of trained items is required, trial and error learning may be more advantageous for memory impaired individuals with greater retention over time due to the increased opportunities for effortful processing and retrieval practice during the learning trials (although see Powell et al., 2012). Thus if the target behaviour, such as using a paper based diary or online calendar, requires the explicit recall of learned information then trial and error learning may be the preferred approach (Middleton & Schwartz, 2012).
Acknowledging the importance of systematic training for successful use of a memory aid, Ownsworth and McFarland (1999) incorporated Self Instructional Training to facilitate an individual’s capacity for self-regulation and self-awareness when using a memory notebook. This top-down cognitive approach to using a memory notebook was trained at a distance with the use of written instructions provided in a letter, in an instruction booklet and verbal instructions over the phone. Another cognitive based approach to the development of self-awareness when using a memory notebook is the use of self-prediction or self-estimation of performance before and after learning activities (Fleming, Shum, Strong, & Lightbody, 2005).

A number of studies do not explicitly state how the memory aid was trained beyond modelling use, verbal instruction, or a review of features (Burke et al., 1994; Depompei, et al., 2008; Fluharty & Priddy, 1993; Zencius et al., 1991), and thus may assume some familiarity with the aid (Gentry et al., 2008). Environmental support is also provided in some training studies in the form of written notes or instruction manuals (Hart et al., 2002). Training can also rely upon the researcher programming the memory aid (Gentry et al., 2007; Yasuda et al., 2002; Kirsch et al., 2004) or input from the support network in the home or social environment (Kerns & Thompson, 1998; Stapelton et al., 2007; Berry et al., 2007). The role of cues in effectively using passive memory aids such as notebooks is mentioned in a number of studies. However, little information about how the subject learnt to use these two aids in synchrony is described (Fleming, et al., 2005; Schmitter-Edgecombe et al., 1995; Schmitter-Edgecombe et al., 2008).

Absence of information regarding the specific instructions that were given hinders replication of the studies and prevents development of a training standard for compensatory memory aids (see Hart et al., 2009). A review of instructional practices for people with memory impairments recommends use of a systematic approach to treatment with clear identification of treatment targets, task analyses in multi-step procedures, error reduction techniques, the provision of sufficient and distributed practise, and strategies to promote effortful processing (Elhardt et al., 2008). This systematic approach to instruction was compared to conventional trial-and-error learning in a randomised controlled trial of training people with acquired brain injury.
to use a PDA (Powell et al., 2012). The key elements of the systematic instruction approach were:

- a limited number of training targets,
- targets broken down into component steps,
- personally relevant training examples,
- instructor models of component steps,
- high rates of distributed practice,
- training outside of the controlled learning environment, and
- probes each session to determine retention.

This training package was compared to trial and error learning which focussed on exploratory learning not mastery. Surprisingly, there was no difference between groups in accuracy and flexibility of PDA use at the end of training. An advantage for systematic instruction only emerged at 30 day follow-up suggesting that this approach supports maintenance of skills (Powell et al., 2012). Systematic instruction also facilitated generalisation of skills.

1.6 Determinants of Outcome of Memory Rehabilitation Programs using Memory Aids

1.6.1 Client characteristics

An appropriate match between the client characteristics and the features of a memory aid will also facilitate long-term use of the memory aid and functional independence. There have been a number of investigations to identify characteristics of the memory-impaired individual which will influence treatment outcome. Wilson and Watson (1996) suggested that people who made good use of memory aids were under 30 years, had a mild memory impairment (a score of 12 or more) as measured by the Rivermead Behavioural Memory Test, did not have other cognitive impairments (notably the absence of executive dysfunction), and used at least five memory aids prior to their injury.

In a replication of this study in a larger sample of people with acquired brain injury, Evans and colleagues (2003) confirmed that less severe memory impairment, the absence of other cognitive impairments and use of at least five aids premorbidly predicted use of six or more aids following their injury. In particular, younger people
were more likely to use memory aids and the longer the time since their injury, the less likely the person was to use memory aids. Performance on a measure of attention and processing speed, the Test of Everyday Attention Map Search scaled score (Robertson et al., 1994), also predicted use of at least three memory aids. The authors argued that clients who are older, longer post-injury, with little premorbid experience of memory aids, and with poor attention will require greater support when being trained in the use of memory aids. Indeed, prior experience with a computer or other electronic aids may influence proficient use of electronic memory aids post injury (de Joode et al., 2010; Cohen-Mansfield et al., 2005).

Kime (2006) has suggested that clients who had good organisational skills prior to their injury or illness have a higher probability of success in using memory aids. Slowly progressive conditions have been associated with rejection of assistive devices (Wessels et al., 2003) and people with depression have a higher rate of non-compliance than nondepressed clients (DiMatteo et al., 2000). Language difficulties, including long-standing problems with reading and writing, may preclude use of a memory notebook (Donaghy & Williams, 1998), or engagement in verbally-mediated training programs.

As noted above, memory aids can be effective in compensating for acquired memory impairments provided the memory impaired individual is adequately instructed in how to use them. Client surveys regularly highlight the need for specific training in how to use compensatory devices (de Joode et al., 2010; Dry et al., 2006; Cohen-Mansfield et al., 2005) in addition to technical support and follow-up (Gilette & DePompe, 2004; Hart et al., 2004; Wessels et al., 2003). The question of how severity of memory impairment affects selection of specific training protocols remains largely unanswered (Elhardt et al., 2008), since instructional techniques appear to have been adjusted on the basis of individual client needs. Wilson and Watson (1996) recommend that memory-impaired clients with additional cognitive impairments will need more intensive training to use compensatory aids. This may include errorless learning techniques, since people with severe explicit memory difficulties- in addition to impairments in monitoring, error detection and attention (Clare & Jones, 2008) - may not benefit from feedback from both correct and incorrect associations in errorful learning protocols. Additional executive impairment has emerged as a barrier to long-
term use of Neuropage (Fish et al., 2008, Emslie et al., 2007), arguing for adaptations to training programs to take into account these additional cognitive impairments, although again this has not been systematically examined. Memory aids may need to be pre-programmed by the therapist or electronically for people with significant executive impairments (O’Connell et al., 2003).

1.6.2 The client’s environment
Factors associated with the client’s environment will also influence treatment success and long term use. Clients with closely involved support network of family, medical staff and co-workers have a higher probability of successful use of memory aids, (LoPresti et al., 2004; Wessels et al., 2003). Provision of memory aids by the rehabilitation centre as opposed to purchased by the patient in the open market, is recommended as this will allow access to the latest technologies and permit more choices. Indeed, it has been suggested that the sooner an individual can be in possession of an assistive device the sooner the client will begin to use it (Wessels et al., 2003). A Memory Aids Clinic may fulfil these environmental demands. In 2003, such a specialised clinic was set up by Dr Narinder Kapur at Addenbrookes Hospital, Cambridge UK to provide a resource centre and display of available memory aids. In addition to providing a supportive clinical environment to advocate the effective use of memory aids, the clinic provided the necessary specialised training to use memory aids to meet every day functional memory goals and to match appropriate memory aids with client needs (see Wilson & Kapur, 2009).

1.6.3 Awareness, engagement and beliefs about memory aids
Impaired awareness of memory problems and other cognitive difficulties is another potential barrier to the effective use of memory aids. It may be that the client does not recognise that their memory function is diminished relative to premorbid function or is unaware of the significance of the impact of these difficulties in their daily lives (Prigatano, 2005; Van den Broek, 2005). Thus a client may refuse to use a memory aid taking the view that “I’m doing fine, I don’t need that thing” (Kirsch et al., 2004). It is also possible that a memory-impaired client does not recall instances of their memory lapses. Discrepancies between self-reports and informant reports of everyday memory function may highlight awareness impairments, in addition to discrepancy
between standardised test performance and subjective reports. Awareness may be impaired at an emergent level such that an individual is unable to recognise the problem when it is actually occurring (Crosson et al., 1989) and thus be unable to use compensatory strategies as the problem arises. Impaired awareness may also result in an individual being unable to anticipate when memory problems may occur, with concomitant difficulty in flexibly adapting the use of memory aids. Whilst impaired awareness of memory problems and the impact of memory problems may arise directly from the neurological insult, social and interpersonal discrepancies as a result of changes in relationships and level of activity post-injury with failure to access appropriate feedback may also maintain poor awareness of difficulties (Gracey et al., 2009) and thus lead to poor use of compensatory memory aids. Client beliefs about their memory, their recovery and use of memory aids also need to be taken into account. In addition to beliefs that they do not need to use a memory aid due to reduced awareness, an individual may not use a recommended memory aid if they believe that it will slow their recovery and make them less reliant on their own abilities (Wilson & Watson, 1996; Baldwin et al., 2011). Stigma attached to using a memory aid (such as a memory notebook), or conversely social status associated with memory aid use (such as a smart phone), may also influence memory aid use. An individual’s perspective of technology may admittedly influence their willingness to adopt and maintain use of memory aids, including a dislike of the inability of the technology to accommodate their limitations (Dry et al., 2006).

It has been argued that the force behind change in rehabilitation is the client’s motivational engagement, such that the client needs to be ready to adopt strategies including memory aids for the compensatory aids to be effective (Van Den Broek, 2005; Kime, 2006). Thus, there is a role for the therapist prior to and alongside training in memory aids to prepare the client for rehabilitation by facilitating motivational engagement and concern regarding their memory difficulties; to work through potential emotional barriers to the use of memory compensations (Baldwin et al., 2011). This may include the exploration of the negative affect associated with using memory aids, including the beliefs about social stigma, the individual’s self-concept and challenging beliefs such as “use it or lose it”. A client centred approach to the use of memory aids is recommended, with establishment of collaborative goals (Hart & Evans, 2006; Cullen et al., 2007) to motivate and energise the client.
Involvement of the client when selecting the memory aid has also been suggested to enhance long term use (Phillips & Zhao, 1993; Gitlin et al., 1996). Difficulty in identifying memory impairments can be addressed with the provision of education, creating lists of strengths and weaknesses, and feedback on task performance with both the client and their support network (Crosson et al., 1989). Video feedback and role play have also been used to facilitate the client’s discovery of memory problems (Crosson et al., 1989; Van Den Broek, 2005), in addition to ratings before and after task performance. Some programs for training the use of memory notebooks have specifically incorporated awareness training prior to skill acquisition sessions (Fleming et al., 2005, Schmitter-Edgecombe et al., 1995), or training to anticipate occurrence of memory difficulties in different contexts (Ownsworth & McFarland, 1999). Engagement in rehabilitation can also be facilitated by exploring the meaning of social, interpersonal and intrapersonal discrepancies post-injury to support psychological growth (Gracey et al., 2009).

Memory aids need to match the goals of the individual, since self-perceived need for memory aids will influence long term use (Gitlin et al., 1996). Clients have expressed preference for a memory aid that helps them to remember appointments, remember conversations, and to keep track of money spent (de Joode et al., 2010). Indeed, electronic memory aids may be more amenable to storing important verbal information (‘remembering what people tell you’) than pen-and-paper memory aids (Hart et al., 2004). A group of older clients also wanted an electronic memory aid to monitor their medications and remember addresses and phone numbers (Cohen-Mansfield et al., 2005). Younger people with neurological disabilities have asked for electronic aids that could store significant amounts of information (Gilette & DePompei, 2004), and people with TBI have been reported to prefer a memory aid that performs a number of functions (Hart et al., 2004). Therapists need to be aware of available memory aids and the features of these memory aids to best meet their client’s goals and needs. Therapists also need to know how to best train the use of memory aids given that clients with memory and other cognitive impairments are likely to have the most difficulty using such supports. In particular, therapists need to feel confident and knowledgeable about electronic memory aids to recommend such devices for their clients (Scherer, 2005; O’Neill-Pirozzi et al., 2004; Dry et al., 2006,
Hart et al., 2004). With a good understanding of electronic memory aids, therapists would be able to know what features to emphasise during training.

1.6.4 Matching the memory aid to the client

The features of the memory aid need to be evaluated to select the most appropriate memory aid for a client. Sohlberg and Turkstra’s (2011) training framework encourages consideration of individual, environmental and memory aid factors to facilitate matching of a memory aid to a memory impaired individual. The most detailed attempts to match memory aids features to client needs have involved the prescription of electronic memory aids. Scherer (2005) has developed a model for matching assistive technology to individuals with cognitive disabilities, taking into account the user’s needs, the user’s environment and features of desirable technology. It includes a detailed history of technology use, discussion of potential barriers to future technology use and a written plan of intervention strategies. Gillette, DePompeii & Goetz have posted a PDA intervention plan that explores environmental factors, personal goals and functions to match not only the memory aid but also the training plan to the memory impaired person (see http://www.brainline.org/downloads/PDFs/PDAInterventionPlan.pdf.). More specifically, a compact and portable memory aid, with clear display features may accommodate the client’s motor and perceptual abilities (Kapur et al., 2004, Kirsch et al., 2004; Wessels et al., 2003). Appearance and size of the memory aid also need to be matched to the individual’s personal preferences. Auditory alarms, for example on a PDA or pill box, need to be sufficiently loud to fulfil the alerting function (Gilette & DePompeii, 2008). Voice cued systems, such as recording devices which play a reminder at pre-programmed times, may be suitable for people with perceptual and/or reading difficulties, since this obviates reliance on a visual display (O’Connell et al., 2003). Cost and availability of technical support may be a barrier to using memory aids (Hart et al., 2004; Gilette & DePompeii, 2008).

Memory aids need to be matched the goals of the individual to facilitate a satisfactory outcome. Different memory aids may support different functions. For example, whilst a computer based calendar may support prospective memory function, a paper based diary can function as a retrospective aid for past events (McDonald et al., 2012). The studies described above for both low technology and high technology memory aids
have focussed on the efficacy of unique devices such as a PDA, voice recorder or diary. Gillespie et al., (2012) suggest a novel but practical conceptualisation for assistive technologies for cognition (ATC) in terms of functionality. The authors classify the functions of ATC devices in terms of ICF cognitive functions (WHO, 2001) with a literature review which suggests that time management is supported by prompting devices, episodic memory by devices which store and display large amounts of information, and organisation and planning by interactive prompting devices. This approach moves away from the use of specific devices to a consideration of the generalizable level of ATC function in cognitive terms, and facilitates the measurement of treatment outcome in terms of changes in activity and participation. For example, the authors cite the strong evidence of the Neuropage study (Wilson et al., 2003) as evidence for a reminding ATC, even though pager technology is now somewhat outdated.

1.7 Measurement of Outcome in Cognitive Rehabilitation

The main objective of the current study is to evaluate the effectiveness of systematic training in the use of memory aids on the management of everyday memory problems. Secondary objectives of the current study examine the impact of training in the use of memory aids on neuropsychological functioning and on psychosocial functioning. Thus, it is important to examine how effectiveness is defined and treatment outcome measured. I will next review measurement of outcome in terms of attainment of rehabilitation goals and use of psychosocial scales. A description of the actual measures used to evaluate the outcome of treatment in the Memory Aids Clinic will be included in the next chapter.

1.7.1 Goal setting and measurement

Measurement of outcome in rehabilitation is difficult due to the heterogeneity of patients and of desired treatment outcomes (Wilson, 2009, Turner-Stokes, 2009). The use of standardised instruments to measure global rehabilitation outcome has been criticised for failing to reflect the client’s individuality. The alternative to a one-scale-fits-all approach to measuring rehabilitation outcome is the use of highly individualised goal setting systems. Indeed, if the aim of rehabilitation is to help a client achieve their personal goals, attainment of goals must be measured (Wilson,
Reflecting on the use of goals in rehabilitation, it has been shown that setting personal goals can enhance behaviour change, presumably through increasing motivation (Wade, 2009), and can facilitate communication between the team members. As goal performance is moderated by the personal importance of the goal and perceived self-efficacy (Lock & Latham, 2002), it is important that goals are set collaboratively with the client. Goals should also be functional, with direct reference to meaningful activities (Randall & McEwan, 2000; Boven’Eerdt et al., 2009) rather than goals that are directed towards the remediation of impairments. Much has been written about how to write rehabilitation goals that are SMART: Specific, Measurable, Realistic/Relevant and Timed (Boven’Eerdt et al., 2009; Wade, 2009). This includes clarification with the client about their desired rehabilitation outcome, providing feedback to the client about their progress, and documenting or recording the goals set. The latter may be particularly important in a population of people with memory impairments.

Specific patient-centred goals can be used to quantify rehabilitation outcome. Goal attainment scaling is a method of scoring the extent to which a client’s individual goals are achieved over the course of an intervention (see Turner-Stokes, 2009) allowing a calibration of the degree of success (Hurn et al., 2006) rather than recording achievement as a pass or fail. However, it has been criticised as being better suited for large randomised controlled treatment trials and less likely to be useful in routine clinical practice (Wade, 2009). Another approach to measurement of goal attainment is the use of semi-structured questionnaires such as the Canadian Occupational Performance Measure (see Hurn et al., 2006; Randall & McEwan, 2000; Boman et al., 2007, Clare et al., 2009). This approach provides a standard format for collaboratively formulating treatment goals, with post-treatment ratings of the client’s perceived change in performance and satisfaction with goal attainment. Finally, individual client goals have been used to measure rehabilitation outcome, an approach that has been validated within an inpatient neurological rehabilitation setting (McMillan & Sparkes 1999). In the seminal Neuropage study into the use of an electronic pager to reduce everyday memory problems, Wilson and colleagues (2001) used a four to seven item questionnaire which listed target behaviours for the intervention, based on earlier discussions of everyday memory failures and reminders likely to be relevant throughout the study period. Participants were asked to record
daily whether or not the targets had been achieved. Similarly, Wade and Troy (2001) identified four or five areas that would be targeted with the use of a mobile phone as a reminder. A diary was constructed for the client and/or their carer to record how frequently target items were remembered across baseline and treatment phases, with analysis conducted in terms of percentage of behaviours that were remembered or self-initiated.

Goal attainment needs to be considered in terms of time, with both short-term and long-term goals. With respect to the training of memory aids, short term goals may reflect mastery of a particular component of a memory aid or efficacy of skill acquisition. For example, measures can be taken to chart success on learning trials during the skill acquisition phase of learning to use a memory aid (Svoboda et al., 2009). This will highlight where training efforts need to be concentrated and can document the client’s progress. Checklists or individually-designed record forms can be used to monitor performance on these short-term goals (see Kime, 2006; Sohlberg, 2005). For example, if the overall goal is to use a paper-based organiser to remember daily tasks, it may be useful to record daily performance on keeping the organiser to hand at all times, entering accurate information or completing homework tasks set by the therapist. The client and their support network need to understand which behaviours are being monitored and how to define and identify these behaviours, including what constitutes a ‘Yes’ or ‘No’ response. Kime (2006) recommends that if a response is not 100% accurate, then the compliance measure should be marked ‘No’ to facilitate learning of the correct behaviour. When training the use of memory aids the number of diary entries or whether the organiser was lost have also been used as outcome measures (Fleming et al., 2005, Ownsworth & McFarland, 1999). Daily checklists of behaviour have also been used to detect change both within and across treatment programs for paper based and electronic organisers (O’Connell et al., 2003), with daily phone calls to ensure compliance (Schmitter-Edgecombe et al., 1995).

1.7.2 Generalisation

Inherent in training the use of memory aids to manage everyday memory problems is the assumption that the training will generalise. Generalisation across settings is an implicit aim of rehabilitation so that a memory aid used within a clinic setting is also used successfully at home (Geusgens et al., 2007). Generalisation can also occur
across behaviours, such as when a memory aid trained to address one behaviour it is then used to successfully tackle a different behaviour. Generalisation can also occur across people, such as when a learning strategy can be successfully used for different clients (Wilson, 2009). However, generalisation of training may not occur spontaneously and must be incorporated into the rehabilitation program (Sohlberg & Raskin, 1996; Wilson, 2009). Transfer of training can be enhanced by selecting a memory aid that matches the client’s goals, cognitive characteristics and environment as noted previously. The training program should incorporate naturalistic tasks and sufficient practice should be allowed to establish the new behaviour (Sohlberg & Raskin, 1996; Goldstein et al., 1998).

Generalisation of the treatment effect can be measured across different levels. Goal attainment of the target behaviour can measure the transfer of learning from the clinic to the home environment through the use of daily checklists as described above. Generalisation has also been measured by examining the transfer of training to non-trained behaviours and to simulated performance of daily tasks in a laboratory environment (Mateer, 2009; Geusgens et al., 2007). The transfer of learning to other aspects of everyday functioning specific to the area of treatment can also be measured, such as the use of an everyday memory questionnaire to assess generalisation of a memory rehabilitation program. Troyer and colleagues (2008) used a novel procedure to determine whether participants could generalise the learned memory strategies to particular problems. In a group of people with MCI, the application of learned memory strategies was assessed by presentation of novel situations in pen-and-paper format. Participants were required to write down strategies which would be useful for each situation and responses were scored for the number and quality (in terms of effectiveness). Training produced generalisation on this pen and paper measure, with maintenance over a three-month period (Troyer et al., 2008). Finally, generalisation to overall functioning in everyday life can be measured with the use of psychosocial questionnaires of participation, quality of life and mood (Sohlberg & Raskin, 1996), such as the Craig Handicap Assessment and Rating Technique-Revised (CHART-R, see Gentry et al., 2008), the Sydney Psychosocial Reintegration Scale (Tate et al., 1999) and the Community Integration Questionnaire (CIQ; Willer et al., 1993). In the past, rehabilitation outcome and generalisation of training have been measured by performance on neuropsychological tests.
tests. However, the effects of training are not expected to transfer to neuropsychological test scores since the goal of rehabilitation is seldom remediation of the impairment itself (Geusgens et al., 2007) and most neuropsychological tests do not lend themselves to the application of rehabilitation strategies (for example, the use of written notes or a recording device is not permitted on standard story recall or list learning tasks).

### 1.8 Summary

There is a growing body of evidence that supports the effectiveness of external compensatory memory aids to improve the everyday function of people with memory impairments. This includes the use of memory aids by people with MCI or early stage dementia. Whilst it is evident that people with memory impairments require training to use memory aids, an effective approach to the systematic training of memory aids has yet to be elucidated and applied to a clinical sample. The current study aims to evaluate a Memory Aids Clinic for the rehabilitation of acquired memory disorders. The Memory Aids Clinic aimed to rehabilitate everyday memory problems secondary to acquired brain injury or illness through the systematic instruction of memory aids.

### 1.9 Objectives

The primary objectives of the current study were:

- To investigate the overall effect of training in the Memory Aids Clinic on everyday memory performance, by comparison of a treatment and a waiting list control group. The treatment group was comprised of a mixed neuropsychiatric sample, including participants with a progressive or non-progressive condition, and was deemed to reflect a typical outpatient clinical sample.
- To examine the maintenance of any treatment effect in the Memory Aids Clinic.
- To examine any generalisation of any treatment effect in the Memory Aids Clinic.

Secondary objectives of the current study included:

- To describe the characteristics of participants who were able to benefit from systematic training in the memory aids clinic.
• To investigate the effect of training in the Memory Aids Clinic on standardised neuropsychological test performance.
• To investigate the impact of training in the Memory Aids Clinic on psychosocial measures.
2 METHOD

2.1 Experimental Design in Memory Rehabilitation
Prior to describing the design, participants and intervention of the current study, some of the challenges inherent in conducting group interventions in memory rehabilitation will be considered. Participants with acquired memory disorders present with different cognitive profiles, aetiologies, treatment goals and emotional status. This clinical heterogeneity dictates that rehabilitation interventions are complex to reflect this diverse range of factors. The challenge of memory rehabilitation research is to determine the effectiveness of interventions and to identify the successful components of an intervention to facilitate generalisation and application of the techniques to other memory impaired individuals (see Cicerone et al., 2009) in the face of heterogeneity.

Intervention effectiveness has been classified according to evidence based clinical practice parameters (see Cicerone et al., 2000). Within this system, a Randomised Controlled Trial (RCT) reflects a Class I study, with a masked outcome assessment in a representative population. Class II studies are prospective, non-randomised cohort studies, including clinical series with well designed controls that permit between subject comparisons of treatment conditions or single subject designs with multiple baselines across two or more subjects (Sohlberg et al, 2005; Sohlberg, 2007). Class III studies include case studies or case series without adequate controls (Sohlberg et al., 2007) which are helpful in guiding efficacy research given the heterogeneity of the memory-impaired population, although generalisation of findings to a larger population may be limited. However, development of the Single Case Experimental Design Scale (Tate et al., 2008) to quantify the methodology of single case designs may provide the necessary experimental control to glean information about an intervention to apply to other individuals with similar characteristics. Class IV evidence is from uncontrolled studies such as case reports (see Elhardt et al., 2008) or expert evidence.

A RCT has often been considered to be the ‘gold standard’ of clinical intervention research (Mateer, 2009). However this research design was developed for clinical drug trials with consistency of treatment in the form of a discrete dose of an agent and
poses many challenges for research into memory rehabilitation. The heterogeneity within the memory-impaired patient population is difficult to accommodate within a RCT, a diversity which is evident in the present Memory Aids Clinic sample. Memory-impaired participants may have a diverse range of aetiologies and a wide variety of cognitive impairments, in addition to other variables such as age, time post-injury, and emotional status which may influence treatment outcome (Mateer, 2009). These different variables make it difficult to apply a consistent treatment within a RCT design. Randomisation is not always possible in rehabilitation programs (Kennedy & Turkstra, 2006) due to clinical needs of individuals. It has also been argued that the ‘masking’ of scorers to the treatment condition is impractical in rehabilitation research and limits the exploration of outcome data, including participation outcomes (Kennedy & Turkstra, 2006; Mateer, 2009). Thus, a RCT may have limited application within memory rehabilitation research.

Until recently, reviews of the use of compensatory memory aids in cognitive rehabilitation identified the evaluation of Neuropage by Wilson and colleagues (2003) as the only Class I RCT (Sohlberg & Turkstra, 2011). In a review of 38 studies (Elhardt et al., 2008) of the effectiveness of memory rehabilitation interventions (which included those that did not use memory aids), the Neuropage study noted above was reported as the only Class II study. No Class I studies were identified. Just over half (55 percent) of the studies were classified as Class III evidence and 37 percent as Class IV. Seven studies into the memory rehabilitation of subjects with dementia did not reveal any Class I or II studies; again the majority were Class III studies (71 percent; Elhardt et al., 2008). As described in Chapter One, the Neuropage study employed a RCT involving a crossover design and demonstrated that when subjects used an electronic paging device significantly more everyday activities were completed. Of note, this study was conducted with 143 participants, a large group study in comparison to the small case series, single cases or smaller group studies that have been reported in the literature. The use of RCTs in memory rehabilitation research is growing, albeit slowly. McDonald and colleagues (2011) used a RCT to demonstrate the effectiveness of Google Calendar compared to a paper based diary to support prospective intentions, although sample size remained small with 12 subjects. Limoncello and colleagues (2011) also used a RCT to demonstrate the superiority of a television based prompting system over usual prompts, with 23 participants.
The majority of studies on the effectiveness of memory aids have used Class II designs and there is increasing support for the use of non RCTs to provide evidence for the effectiveness of cognitive rehabilitation (Cicerone et al., 2009). Cicerone and colleagues (2009) have suggested that internal validity, descriptive and statistical criteria should be applied to assess the methodological quality of cognitive rehabilitation interventions. Criteria for internal validity include details of inclusion/exclusion criteria, randomisation, allocation, baseline characteristics, description of interventions, co-interventions, and outcome measures. The descriptive criteria refer to dropout rates, length of outcome assessment, timing of outcome assessment and sample size. Finally the statistical criteria refer to the analysis, measures of variability, and a statistical comparison of the treatment effect. These criteria facilitate the evaluation of observational cognitive rehabilitation studies, thus supporting the use of designs other than a RCT.

2.2 Design
In the current study, a comparison was made between a treatment group and a waiting list control group in a between-subjects design. The main outcome measure was everyday memory performance as measured by a memory diary. The effect of treatment on this measure was compared between the treatment and control group across the three time points of baseline, end of treatment (six weeks after baseline) and follow-up at 12 weeks. The effect of treatment on performance at neuropsychological tests and psychosocial measures was examined across groups at two time points- baseline and follow-up across both groups. Treatment impact was also assessed by comparing responses on a Problem Solving Inventory across groups at the two time points of baseline and follow-up. The intervention was then examined in more detail with an analysis of a case series of participants with progressive or non-progressive aetiologies.

The current study meets the criteria for a Class II study as participants were randomly allocated to groups, with every third referral allocated to the waiting list control group. The use of a control group in clinical investigations does raise practical and ethical issues surrounding access to service and poses a problem for research into neuropsychological rehabilitation (see Sohlberg, 2005; Sohlberg et al., 2007). Typically, the length of time over which rehabilitation may have its effects (many
months or years) can be longer than those required to deliver specific interventions in a standard randomised controlled trial and so may hinder the use of a waiting list control group (Turner-Stokes et al., 2005). Comparison conditions in memory rehabilitation studies have included baseline comparisons (Ownsworth & McFarland, 1999) and memory notebook versus supportive therapy (Schmitter-Edgecombe et al., 1995). The current study addressed the issue of access to treatment for the control group with the provision of written material on the management of memory problems (Kapur, 2001). This was given at the baseline assessment session with the explanation that treatment would be delayed. Participants continued to receive their standard care provided by other clinical services and none of the control subjects received psychological intervention from another agency during the waiting period. Control subjects received treatment in the Memory Aids Clinic eighteen weeks after the baseline assessment. Therefore all subjects received treatment over time.

A power analysis was conducted to establish participants numbers in the current study with reference to data from the Wilson and colleagues studies (2003) into the use of Neuropage to improve everyday memory function. This study was somewhat unique in the field of memory aids research due to the large sample size (n = 143). The mean difference in percentage success rates in attainment of everyday memory goals with and without the pager was 25.84. Using this difference, on the basis of two sided testing and with power set at 90%, we aimed to recruit 60 subjects to the treatment group and 20 subjects to the control group to achieve a significant result with sufficient power.

2.3 Participants
One hundred and twenty eight patients were referred for treatment in the Memory Aids Clinic. Participants were accepted into the study on the basis of subjective reports of everyday memory problems which had been verified by the referring agent, neuropsychological assessment or both. Participants were required to have sufficient conversational English to understand assessment and rehabilitation procedures. Participants were not excluded on the basis of previous psychiatric history, neurological insult or drug and alcohol history. On the basis of these inclusion and exclusion criteria the final sample was a mixed neuropsychiatric group with a range of primary diagnoses and was deemed to be representative of patients presenting to a
standard memory clinic (see Kennedy & Turkstra, 2006). Referrals to the Memory Aids Clinic were primarily from the Neuropsychiatry and Memory Disorders clinic, based at St Thomas’ Hospital, London (Kopelman & Crawford, 1996). This service provides an outpatient specialist memory disorders services for people with memory complaints secondary to neurological disorders, possible early dementias and memory complaints thought to have a psychological or psychiatric causation. Other referrals to the Memory Aids Clinic were received from consultant neurologists, clinical psychologists, and general practitioners. There were two self referrals.

One hundred and twenty eight participants were recruited. Eighty-eight were included in the treatment group and 40 were allocated to the waiting list control group (see Figure 1). Allocation to the control group was randomised on the basis of every third referral.

Of the 88 participants in the treatment group, 75 attended an initial appointment. Sixty three of these subjects went on to complete treatment. Twelve did not complete the treatment due to poor compliance/failure to attend appointments (n=5), refusal of the offer of treatment (n=5), and closure of the clinic (n=2). Thirteen subjects who were included in the treatment group did not attend an initial appointment due to refusal of the offer of treatment (n=6), failure to attend (n=4), and living out of area (n=3). Of the 63 participants in the treatment group, 44 had a non-progressive condition and 19 had a progressive condition. The primary diagnosis was determined by the referring agent. The diagnoses of the treatment participants in the non-progressive sub group were stroke or ‘vascular’ (n=8), seizure disorder (n=8), traumatic brain injury which ranged from severe to post concessional syndrome (n=6), hypoxic brain injury (n=5) including two with presumed perinatal injuries, Human Immunodeficiency Virus (n=4), brain tumour (n=4), encephalitis (n=3), Systemic Lupus Erythematosus (n=3), alcohol-related cerebral dysfunction (n=2), and myalgic encephalopathy (n=1). Time since insult to the baseline assessment was an average of 62.9 months (S.D. 76) with a range of one to 360 months. Diagnoses of treatment participants in the progressive sub-group were: Mild Cognitive Impairment (n=12), Alzheimer’s dementia (n=3), vascular’ such as small vessel disease (n=2), and multiple sclerosis (n=2).
Of the 40 participants in the control group, 36 attended an initial appointment. Four control subjects did not have an initial appointment due to failure to attend (n=2) or decline the offer of treatment (n=2). Of the 36 who attended an initial appointment, 28 completed the review assessment and treatment. Nine control subjects did not complete treatment due to poor compliance/failure to attend appointments (n=2), refusal of the offer of treatment (n=3), referral for community support (n=2) and due to unforeseen closure of the clinic (n=2). Four of the control subjects underwent treatment with a pilot protocol, with the review assessment and final memory diary measure taken at the conclusion of treatment. These data was not included in the analysis. The 24 control subjects who attended for the review assessment and
treatment included 10 subjects with progressive and 14 subjects with non-progressive conditions. Of the control subjects who had a non-progressive condition, the diagnoses were: alcohol related brain dysfunction (n=5), ‘vascular’ including stroke (n=4), seizure disorders (n=3), traumatic brain injury (n=1) and hypoxic brain injury (n=1). Time since insult to the baseline assessment was an average of 40.9 months (S.D. 64.3) with a range of one to 252 months. The control subjects in the progressive sub-group had diagnoses of: Alzheimer’s dementia (n=5), ‘vascular’ (n=3), and Mild Cognitive Impairment (n=2).

2.4 Measures

2.4.1 Functional Goal Attainment:

Treatment outcome was measured by attainment of specific everyday memory goals. Goal attainment was measured with a daily record sheet, modelled on that used to evaluate the electronic memory aid, Neuropage (Wilson et al., 2003) and the use of a mobile phone as a memory aid (Wade & Troy, 2001). Everyday memory goals were listed on the left side of a one week to a page diary (see Appendix 1). At the end of each day, participants were asked to record whether they had achieved that memory goal. Responses were recorded as a yes/no or as a tick or a cross, depending on the participant’s preference. As performance was rated across each day, participants were instructed to mark a ‘yes’ if they felt that on the whole they had achieved that goal or ‘no’ if they had not been able to achieve that task across the day. Carers, if present, were encouraged to support the participant in completing the diary.

Goal attainment was recorded across a two to 14 day period at baseline, the end of training (six weeks after baseline) and at follow-up. The large variation in the number of days on which goal attainment was recorded reflects the frequency with which some activities occurred and that some subjects forgot to complete the diary every day across the nominated period. For example, a participant’s goal may have been to remember to turn off the stove which was not recorded for the days they did not cook. In the treatment group, goal attainment was measured by completion of the daily diary of memory performance prior to treatment, at the end of treatment, approximately six weeks later, and at follow-up, three months after the end of treatment. In the control group, goal attainment was measured after the initial assessment, approximately six
weeks after the initial assessment and then three months later, immediately prior to treatment. In this way, measures of goal attainment were taken at the same time points for both the treatment and control groups.

The goal attainment diary was scored by recording the number of days a goal was successfully performed relative to the number of days performance on that goal was recorded to achieve a proportion of goal attainment. A percentage reflecting successful attainment was then calculated for each goal. To determine overall goal attainment at baseline, end of treatment and follow-up, the number of ‘yes’ responses was divided by the number of days that goal attainment was recorded for each goal. For example, if at baseline goal one was attained with a success rate of 5/10 and goal two with a success rate of 2/10, the overall goal attainment at baseline was measured at 7/20. This method of measuring goal attainment was based upon that work of Wilson and colleagues in evaluating Neuropage (Wilson et al., 2003).

2.4.2 Neuropsychological assessment measures
The purpose of the neuropsychological assessment was to document each participant’s cognitive strengths and weaknesses across a number of cognitive domains. In this way, cognitive factors that may influence treatment outcome could be investigated. Selection of neuropsychological assessment measures was influenced by previous research into cognitive characteristics that determined successful use of memory aids (Wilson & Watson, 1996; Evans et al., 2003) and studies that evaluated effectiveness of memory aids (e.g. Stapelton et al., 2007; Boman et al., 2007, Wilson et al., 2003, Ownsworth & McFarland, 1999). However, to extend further this body of research, the selection of neuropsychological assessment measures in the present study also aimed to sample a wide range of cognitive domains to determine additional cognitive characteristics that may influence use of memory aids. In addition, with the review assessment following treatment, neuropsychological tests with available parallel forms were selected to minimise practice effects. In those cases where parallel forms were not available, interpretation of results at the second assessment was made with consideration of test re-test intervals as reported in test manuals.

The neuropsychological test battery assessed the cognitive domains of premorbid cognitive functioning, general cognitive abilities, everyday memory, prospective
memory, attention/concentration, and executive function. All neuropsychological tests were administered and scored according to the standardised instructions as described in each test manual. Neuropsychological assessments were conducted within the Memory Aids Clinic by the treating neuropsychologist, Bonnie-Kate Dewar, apart from 26 follow-up assessments which were conducted by locums during two separate periods of maternity leave. As noted, the primary source of referrals was the Neuropsychiatry and Memory Disorders clinic, based at St Thomas’ Hospital, London (Kopelman & Crawford, 1996). Participants referred from this clinic had undergone a neuropsychological assessment as part of their routine clinical assessment. If this assessment had been conducted within six months of the Memory Aids Clinic baseline assessment, test scores from the Neuropsychiatry and Memory Disorders clinic were used to minimise practice effects. The scores most commonly used in the Memory Aids Clinic were from tests of premorbid function (Wechsler Test of Adult Reading UK, Wechsler, 2001), general intellectual function (Wechsler Adult Intelligence Scale Third Edition, Wechsler 1997; Wechsler Abbreviated Scale of Intelligence, Wechsler, 1999) and executive function (Brixton Spatial Anticipation Test (Burgess & Shallice, 1997).

The neuropsychological test battery was as follows:

**National Adult Reading Test- Revised (NART-R; Nelson & Willison, 1991) or Wechsler Test of Adult Reading UK, (Wechsler, 2001).**

This single word reading test provides a measure of premorbid cognitive functioning and was developed for use with the Wechsler Adult Intelligence Scale- Revised (Wechsler, 1981). The participant must read aloud 50 irregularly spelled words. The Wechsler Test of Adult Reading UK is a similar single word reading test which allows prediction of performance on the Wechsler Adult Intelligence Scale Third Edition (Wechsler, 1997).

**Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999).**

The WASI aims to give a brief estimate of intelligence and was designed as a screening instrument when more complete assessment of IQ is not necessary, such as in research settings (Strauss et al., 2006). The two subtest short form was administered and was comprised of the Vocabulary and Matrix Reasoning subtests.
**Vocabulary:** Participants were presented with a series of words within a stimulus booklet. They were then asked to provide a definition for each word. The stimulus booklet also included some lower level items where participants had to name a picture.

**Matrix Reasoning:** Tapping into perceptual reasoning skills, the participant views an incomplete matrix or series and selects the response option that completes the matrix or series.

**Rivermead Behavioural Memory Test Extended (RBMT-E; Wilson et al., 1999).**
The RBMT- Second Edition (Wilson et al., 2003) was designed to detect impairment of everyday memory function and change over time. The RBMT-E is a more sensitive measure than the Rivermead Behavioural Memory Test (Wilson et al., 1985) as it has been made more difficult by doubling the amount of information to be remembered. It consists of 11 subtests chosen after an investigation into the types of memory problems most commonly experienced by people with acquired brain injury. Tasks include remembering names, story recall, picture recognition, and remembering a route around the room. Prospective memory is assessed on three measures and two of the tasks have a delayed memory component.

**The Cambridge Prospective Memory Test (CAMPROMPT; Wilson et al., 2005).**
The CAMPROMPT is a measure of prospective memory, the ability to remember to perform a future task. The subject is asked to complete three time based and three event based tasks, with the optional support of written notes or other memory strategies.

**Wechsler Adult Intelligence Scale- Third Edition (WAIS 3; Wechsler, 1997).**
The WAIS 3 is designed to provide a measure of general intellectual function in older adolescents and adults. It is comprised of 14 subtests, but in the current study the following subtests from the WAIS 3 were administered: Letter Number Sequencing and Digit Symbol.

**Letter Number Sequencing:** A task of auditory verbal working memory, the participant is read a sequence of numbers and letter and recalls the numbers in ascending order and then letters in alphabetical order.
Digit Symbol: In a test of processing speed, the participant must copy symbols that are paired with numbers, within a specified time limit.

The Test of Everyday Attention (TEA; Robertson et al., 1994).
A battery of eight subtests, the TEA is designed to assess various attentional components with a degree of clinical utility to assist in predicting recovery of function and daily life function after acquired brain injury (Strauss et al., 2006). Three versions of the TEA are available; version A and B were used in the current study. The following subtests from the TEA were administered: Elevator Counting, Telephone Search, Telephone Search while Counting.

Elevator Counting: This is an auditory sustained attention task where participants must count a series of tones presented on an audio CD.

Telephone Search: This is a selective attention task where participants must search for targets amongst distracters in a simulated telephone directory.

Telephone Search while Counting: This is a test of selective and divided attention. Participants must visually search for targets amongst distracters whilst simultaneously counting strings of tones presented on an audio CD.

Behavioural Assessment of the Dysexecutive Syndrome battery (BADS; Wilson et al., 1996).
The BADS consists of seven subtests and a questionnaire designed to predict everyday problems arising from executive function disturbance. The Zoo Map subtest was administered.

Zoo Map: Participants show how they would visit a series of designated locations on a map of a zoo, adhering to certain rules. There are two trials on this task. The first trial makes high demands on planning abilities. In the second, low demand trial, structure is placed upon the task and the participant must only follow the instructions to produce an error-free performance.

Brixton Spatial Anticipation Test (Burgess & Shallice, 1997).
Designed to be sensitive to executive dysfunction, the Brixton Spatial Anticipation Test is a rule attainment task (Strauss et al., 2006) in which the rule cannot be determined from the perceptual characteristics of the stimuli. Participants are shown an array of ten circles in which one is coloured blue. The position of the blue circle
changes from one page to the next, according to a simple rule that changes without warning. The participant must determine the rule on the basis of what they have seen on previous pages.

2.4.3 Psychosocial questionnaires:
There is growing awareness of the need to address the interaction of cognitive impairments with emotional and social functioning. Adopting a biopsychosocial approach to cognitive rehabilitation acknowledges that cognitive impairments do not occur in isolation but recognise the complex interplay between biological, psychological and social influences on behaviour (Wilson, 2009; Williams & Evans, 2003, see also Yates, 2003). Such an approach also reflects the World Health Organisation’s International Classification of Functioning of impairment, functional ability and participation (WHO ICF, 2001). Rehabilitation should not only be directed to the alleviation of cognitive impairments but also address meaningful activity levels and participation.

To investigate the impact of rehabilitation within the Memory Aids Clinic on psychosocial function a number of measures were administered before and after treatment. These measures, as described below, aimed to investigate changes in mood, self-esteem, subjective perception of memory difficulties, participation and carer strain.

Beck Depression Inventory Second Edition (BDI-II; Beck et al., 1996)
The BDI-II is a self-report instrument for measuring the presence and severity of depression in adults and adolescents. The questionnaire consists of 21 groups of statements. The participant must read through each group of statements and select the statement that best describes the way in which they have been feeling for the past two weeks, including the day of assessment. The BDI-II is scored by adding the highest score circled for each of the 21 items.

Rosenberg Self Esteem Scale (Rosenberg, 1965)
The Rosenberg Self Esteem Scale is a ten-item questionnaire that measures global self-esteem. Participants respond on a four point Likert-type scale which ranges from strongly agree to strongly disagree. The Rosenberg scale was selected for use in the
current study because of its good reliability and construct validity (Keppel & Crowe, 2000) and its widespread use in social scientific research, including acquired brain injury populations (Cooper-Evans et al., 2008). The scale ranges from zero to 30, with a higher score indicating higher self-esteem.

**Prospective Retrospective Memory Questionnaire (PRMQ; Crawford et al., 2003; Crawford et al., 2006).**

The PRMQ was developed to provide a self-report measure of prospective and retrospective memory slips in everyday life. It has 16 items—eight measure prospective memory (when things should be remembered e.g. “If you tried to contact a friend or relative who was out, would you forget to try again later?”) and eight measure retrospective memory (what should be remembered e.g. “Do you forget something you were told a few minutes before?”). Participants are asked to rate how often a set of minor memory slips happened to them on a five-point scale: Very Often, Quite Often, Sometimes, Rarely, and Never. Scores on the PRMQ range from 16 to 80, and are converted to T-scores for calculation of discrepancies between reports of prospective and retrospective memory.

A proxy-rating version of the PRMQ (Crawford et al., 2006) was administered to the carer or significant-other of the participant. Participants were asked to choose someone they knew well and ask them to complete the proxy version of the PRMQ. Most often this was the family member, friend or carer who attended the baseline session with them. The proxy rater was asked to record their estimate of how often each type of memory failure occurred on the same five-point scale. Again, the proxy PRMQ scores range from 16 to 80 and are converted to T-scores to examine discrepancies between participant and proxy rater and between ratings of prospective and retrospective memory performance. Discrepancies between participants and proxy ratings may reflect poor insight into memory problems on the part of the participant and proxy ratings of everyday memory function have been reported to have a higher correlation with objective measures of memory than do self-ratings (Crawford et al., 2006).

**Community Integration Questionnaire (CIQ; Willer et al., 1993)**
The CIQ was designed to assess home integration, social integration and productive activity in persons with acquired brain injury. It is a 15-item questionnaire which is completed by the participant or with the assistance of a person familiar with the participant’s activities. Questions are directed at how the participant performs a specific activity within the household or community, with responses typically reflecting the degree of independence. The overall score range from zero to 29, with higher scores reflecting greater integration. The CIQ was selected for use in the current study as a means of measuring participation, according to the WHO ICF (2001; see Whiteneck & Dijkers, 2009).

Modified Caregiver Strain Index (CSI; Robinson, 1983).

The original CSI is a self-report instrument designed to assess strain in care givers helping when someone has an illness or when someone has returned home from hospital. The modified version was tailored towards potential stressors of particular relevance in cases of acquired brain injury (Teasdale et al., 2009). In the current study, carers/significant others of participants responded ‘Yes’ or ‘No’ to 16 questions, with higher scores reflecting higher levels of strain.

Subjective Rating of Memory Function

A subjective rating of each participant’s memory function was also obtained with a brief questionnaire designed for the current study (see Appendix 1). This questionnaire assessed perceived severity of memory problems, perceived stress associated with memory problems, the perceived impact of memory problems on functioning at home, perceived impact of memory problems on functioning in social settings and perceived impact of memory problems on work function. Each question was rated on a scale from 0 to 10, where low scores indicated minimal problems, stress and impact on function and higher scores indicated significant problems, stress and impact on function.

2.4.4 Generalisation of Treatment

Generalisation of treatment effects is an important component of cognitive rehabilitation (Wilson, 2009). Different aspects of generalisation were investigated within the Memory Aids Clinic. Generalisation across settings- from the clinic setting to the home environment was measured by checklists to ensure compliance in using
the memory aid and goal attainment measures at the end of training and at follow-up. To measure generalisation across behaviours and knowledge of memory aid use, a questionnaire was designed for the current study as described below.

**Problem Solving Inventory (PSI):**
To assess generalisation of memory aid use in everyday life, a list of 18 scenarios requiring the application of a memory strategy such as remembering past events, remembering to buy milk, recalling instructions etc. (see Appendix 1) was developed for the present study. Participants were required to write down what they would do in these situations, listing as many strategies as they could think of. The PSI was administered at baseline and at follow-up. Responses were scored according to the number of strategies listed and the number of different strategies listed. For example, some participants used the same memory aid for a number of the hypothetical scenarios. The PSI was loosely based upon Troyer and colleagues’ (2001; 2008; see also Kinsella et al., 2009) assessment of memory strategy use, in which participants are required to write memory strategies for six hypothetical memory situations.

**2.5 Procedure:**
The Memory Aids Clinic was established in November 2006 with funding from the Guys and St Thomas’ Charity. The project was approved by the South London and Maudsley Mental Health Trust National Division clinical governance meeting after a review by the chair of the Guy’s and St Thomas’ Local Research Ethics Committee. Participants were given written information regarding the study and gave written consent prior to the commencement of treatment (see Appendix 2).

A summary of the intervention is presented in Table 1. Full details of this procedure are listed in the accompanying text.
Table 1: Treatment Protocol for Memory Aids Clinic

Treatment group subjects were seen for five sessions: baseline assessment and interview, three training sessions across a six week period and a follow-up assessment 12 weeks after the end of training. Subjects in the control group were seen for baseline neuropsychological assessment and were then placed on a waiting list for 18 weeks before being assessed for goal attainment.
weeks. This is equal to the length of treatment (six weeks) and the follow-up period (12 weeks). At the end of this waiting period, control group subjects underwent a follow-up assessment prior to treatment which consisted of three sessions over a six week period.

At baseline, all control subjects were given the “Managing your Memory” manual (Kapur, 2001), a handbook of strategies for everyday memory problems, and were told that their treatment would begin after a delay. As described below, at baseline participants in the control group were given a diary to complete and return to the neuropsychologist in a stamped addressed envelope. A second diary was then sent to control subjects approximately six weeks after the baseline session, with a stamped addressed envelope to facilitate return to the neuropsychologist. Control subjects were also reminded to return the baseline and six week diaries via telephone, text messages or email. After the 18-week wait, control subjects completed the follow-up diary which was sent with the appointment for the follow-up assessment. After the follow-up session, control subjects underwent the treatment protocol.

2.5.1 Baseline
All participants underwent a baseline neuropsychological assessment using the tests described above of up to three hours. Written information about the study was provided and informed consent was obtained (see Appendix 2). The assessment was made up of an initial interview which gathered information on current subjective cognitive complaints and strategies currently used to manage memory difficulties. Information on educational and occupational history, medical history and psychosocial functioning was also gathered. In addition, a participant’s use of memory aids was explored. On the basis of Evans et al., (2003), participants were asked if they used the following memory strategies- notes, diary, lists, wall chart/calendar, mental retracing, asking others, leaving objects in usual places, mobile phone, electronic organiser, watch/clock or any other memory aids/strategies. These were the most commonly used strategies or memory aids in a sample of 94 people with memory difficulties subsequent to acquired brain injury (Evans et al., 2003). Expectations and attitudes towards memory aids were also explored. Participants were asked how they believed ‘their memory could get better’, what they thought about the use of memory aids, and how they would like their situation ‘to be different from how
they are now’. The interview was conducted with the participant and an informant (partner, other family member or carer) when available.

To gather additional information about the type and frequency of their everyday memory problems, all participants were sent a 29-item memory diary with their appointment letter (see Appendix 3). This was a modified version of the Everyday Memory Questionnaire (EMQ; Sunderland et al., 1983) which has previously been used to plan rehabilitation programs for people with acquired brain injury (see Wilson, 1996). It is a list of 29 common memory complaints. For the two-week period prior to the initial appointment, subjects were asked to record which of the 29 items they experienced and how often these problems occurred. A final question allowed participants to record any additional memory difficulties not covered by the 29 questions. The aim of collecting this information was to assist goal setting with the identification of the most important and frequent everyday memory problems and to supplement information provided during the initial interview. On occasion, participants did not complete the memory diary as they had forgotten to do so or had lost the EMQ diary. When this occurred, information on subjective complaints provided in the interview was used in to establish goals for the treatment program.

At the end of the interview, subjects were asked to select goals to work on in the Memory Aids Clinic. These were based on current subjective complaints as described in the initial interview, the modified EMQ and any additional information such as feedback from the informant. Goals were set collaboratively. The participant was asked to nominate the areas of their everyday memory function in which they would like to improve. Carers were involved in goal setting at the participants’ discretion. Probes included asking the participant to reflect on those memory problems that caused them frustration or memory problems which had recently lead to significant personal complications (e.g. burning food when cooking, not paying bills, or failing to meet a friend for a lunch appointment). Additional probes included reflection on the items endorsed in the modified EMQ and providing feedback on subjective complaints discussed in the clinical interview. The purpose of goals to focus and energise treatment was discussed and information regarding the role of goals to measure treatment outcome was also provided. Goals were then selected. A sample of the most common goals selected by subjects is shown in Table 2. The average number
of goals for subjects in the treatment group was 2.9 (S.D. 0.8) In the control group, 
the average number of goals was 3.0 (S.D. 0.7) Independent t-tests (two tailed) did not 
indicate any significant difference between treatment and control group with respect 
to the number of goals selected. Each participant was provided with a written list of 
their Memory Aids Clinic goals at the first training session.

Table 2: Target goals identified at baseline in Memory Aids Clinic.

<table>
<thead>
<tr>
<th>Goal identified at baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>To use the cooker safely</td>
</tr>
<tr>
<td>Medication management</td>
</tr>
<tr>
<td>To remember future plans (e.g. appointments, to send a birthday card)</td>
</tr>
<tr>
<td>To remember daily tasks (e.g. daily walk, morning routine)</td>
</tr>
<tr>
<td>To find belongings within the house</td>
</tr>
<tr>
<td>To remember remote events (e.g. family holidays)</td>
</tr>
<tr>
<td>To remember recent events (e.g. what I did last weekend)</td>
</tr>
<tr>
<td>To not have to go back and check that I have done something</td>
</tr>
<tr>
<td>To remember to cross the road safely</td>
</tr>
<tr>
<td>To remember to lock windows/doors or turn off the iron/bath/lights</td>
</tr>
<tr>
<td>To remember to take things with me as I leave (e.g. keys, phone, bus pass, medication)</td>
</tr>
<tr>
<td>To be more organised, including using memory aids more effectively</td>
</tr>
<tr>
<td>To feel more confident</td>
</tr>
<tr>
<td>To remember what I have read</td>
</tr>
<tr>
<td>To remember what I have been told, including conversations</td>
</tr>
<tr>
<td>To pass on (phone) messages</td>
</tr>
<tr>
<td>To remember to use my hearing aid</td>
</tr>
<tr>
<td>To find the words I want to use</td>
</tr>
<tr>
<td>To keep track of tasks</td>
</tr>
<tr>
<td>To remember names</td>
</tr>
<tr>
<td>To remember what I need to buy when shopping</td>
</tr>
<tr>
<td>To find where I parked my car</td>
</tr>
<tr>
<td>To remember what I went downstairs for</td>
</tr>
<tr>
<td>To find my way</td>
</tr>
</tbody>
</table>

Some participants had difficulty setting goals due to lack of insight into their memory 
difficulties or poor awareness of the impact of their memory problems on their 
everyday functioning. For example, some participants stated that although they had 
memory problems, the difficulties did not impact upon what they wanted to do, 
possibly because of support from their partner or family member. When goal setting 
was challenged by limited insight, the participant was asked whether there was any 
aspect of their daily life in which he or she wanted to be more independent. For 
example, if his or her spouse managed their medication or arranged medical 
appointments, the participant was asked whether this was a daily function that he or
she wanted to do for themselves. In cases where the participant refused the offer of treatment by minimising the significance of their memory impairment (in the presence of reports of significant difficulty or dependence from others and/or background referral information and/or impairment on formal neuropsychological assessment), he or she were asked to select one goal in collaboration with the research clinical neuropsychologist and their informant. Another challenge to goal setting came from participants who aimed for expansive goals within the setting of a three-treatment session program. For example, some participants wanted to return to work or study. In these cases, goals were discussed in terms of the steps required to achieve larger aims. To balance the intensity of therapy offered in the Memory Aids Clinic with these long-term goals, collaborative discussion identified smaller steps/goals that, if attained, could facilitate return to work or study.

Once goals had been agreed upon, participants were given the goal attainment diary as described previously. Each goal was listed on a week to a page diary. Participants asked to record each day whether the goal was achieved with a yes/no or tick/cross response. As performance was rated across each day, participants were instructed to mark a ‘Yes’ if they felt that on the whole they had achieved that goal or ‘No’ if they had not been able to remember that task across the day. The diary was to be completed for 10 days and formed a baseline measure for functional goal attainment. The memory demands of completing the diary each day was discussed and subjects were asked how they were going to remember to complete the diary. If they were unable to identify a strategy to support completion of the memory diary, strategies were discussed including enlisting the support of a significant other, using existing memory aids or leaving the diary in a prominent location. If participants used a mobile phone, an online automated text messaging service (http://www.textanywhere.net) was used to send a text based reminder at a predetermined time. The message asked the participant to complete their memory diary for today. They did not have to respond to the text message. Subjects were to return the completed diary at the initial session. Subjects in the control group returned the diary via a stamped addressed envelope. They were sent text reminders to do so if appropriate and given telephone reminders to chase up delayed returns.

The order of administration of the neuropsychological test battery was as follows:
1. Subjective Rating of Memory Performance
2. National Adult Reading Test-Revised
3. Rivermead Behavioural Memory Test- Extended Version A
4. Digit Symbol (WAIS-3),
5. Elevator Counting (TEA) Version A
6. Telephone Search (TEA) Version A
7. Telephone Search while Counting (TEA) Version A
8. Zoo Map (BADS)
9. Letter Number Sequencing (WAIS- 3),
10. Brixton Spatial Anticipation Test
11. Wechsler Abbreviated Scale of Intelligence
12. Cambridge Prospective Memory Test Version A
13. Beck Depression Inventory-II
14. Prospective Retrospective Memory Questionnaire
15. Rosenberg Self Esteem Scale
16. Community Integration Questionnaire
17. Problem Solving Inventory

As noted previously, if the subject had undergone neuropsychological assessment in the six months prior to the baseline session, test scores were obtained from this assessment to reduce practice effects. Informants were asked to complete the Carer Strain Index and the informant’s version of the Prospective and Retrospective Memory Questionnaire whilst waiting for the assessment to be completed. If the participant attended the baseline assessment alone, they were asked to give these two questionnaires to someone who knew them well and for the completed questionnaires to be returned at the first treatment session.

At the end of the baseline session, and indeed at the end of every Memory Aids Clinic session, all participants were given a written summary of the session content (see Appendix 3). This included content of the session (review of subjective memory problems and identified goals for the Memory Aids Clinic), details of the next appointment including date and planned content, tasks for the clinical neuropsychologist to complete prior to the next session and tasks for the participant to complete (the memory diary and any outstanding questionnaires for informants). All
participants were given a red folder to organise and store written information, session summaries and appointment letters from the Memory Aids Clinic.

2.5.2 Treatment protocol:
The intervention consisted of three sessions of one and a half to two hours each. The training sessions were held across a six-week period. Training followed the principles of Sohlberg and Mateer’s (1989) acquisition, application and adaptation approach to train the use of memory aids (see section 1.2.1). During the acquisition phase, training focused on learning the components of how to use the memory aid. The intervention then focussed on the application of this knowledge to show understanding of when and where to use the memory aid. Finally, the intervention focussed on generalisation, with adaptation of memory aid use in novel situations both in and out of the clinic.

Each memory aid was analysed to develop a specific training protocol for that memory aid. The analysis focused on the mechanics of the components, for example how to record a message on a voice recorder, how to turn the device on or off, or how to set an alarm on a medication reminder. The analysis also focussed on how to apply key functions of the memory aid in everyday situations. Information from this analysis formed the detailed training protocol for each memory aid. In addition to describing the key features of the memory that needed to be addressed in training, the training protocol also included in-session examples. These were employed by the neuropsychologist to practise use of the memory aid in clinical sessions and in homework assignments that the participant conducted between sessions. As part of the analysis of each memory aid, an amended information sheet was developed with consideration of the participants’ cognitive impairments. A manufacturer’s information sheet was provided with most memory aids. This was amended to highlight important information regarding the use of components and common uses of the memory aid by people with memory impairments. Information regarding maintenance of the memory aid (e.g. cleaning, renewing pages or changing batteries) was highlighted and contact details for the Memory Aids Clinic were emphasised.

Memory aids were selected on the basis of the participant’s goals and taking into consideration memory aids that he or she currently used or had used in the past. Table 3 lists the memory aids and cognitive rehabilitation strategies used to address
participant’s goals, including the number of participants who nominated these domains as goals to work on in the Memory Aids Clinic. Attitudes to memory aids as gleaned from the clinical interview also influenced selection of the memory aid. For example, if the goal was to remember appointments, the participant might be offered the use of a smart phone or a paper-based organiser, depending on their personal preference. If a participant did not express confidence in the use of an electronic memory aid, alternative supports were explored. Importantly, the participant was involved in the selection of the memory aid. The Memory Aids Clinic resource centre had a variety of memory aids, including a number of memory aids serving the same function. This allowed the treating clinical neuropsychologist to offer different models of memory aids to the participant, thus involving them in the treatment process. For example, using the example described previously, the participant would be offered a number of paper-based diaries to meet their goal of remembering appointments - a day-to-a-page-diary, a Filofax to allow the addition of notes or lists, or a small portable week-to-a-page diary.

A photograph of the Memory Aids Clinic is shown in Figure 2. With an appreciation of the participant’s cognitive strengths and weaknesses as informed by the baseline assessment and knowledge of the participant’s environment and activities, the clinical neuropsychologist was able to provide advice on the most appropriate memory aid to meet the individual’s goals. It was expected that the cognitive profile would remain stable over the six week training period and so training was based on baseline performance and identified goals. The cognitive profile of the participant had a greater influence on the training protocol used as opposed to the type of memory aid adopted. The exception was when working with participants who had dyspraxia, visuospatial or motor impairments since, in these rare cases memory aids were suggested that had modifications to accommodate these impairments. The Memory Aids Clinic provided all memory aids to participants and thus training was conducted with the memory aid that the participant used at home, at no financial cost to the participant.
### Table 3: Target Goals and Memory Aids used to Meet these Goals, including Number of Participants who Nominated these Goals.

<table>
<thead>
<tr>
<th>Goal identified at baseline</th>
<th>Number of participants who nominated this goal</th>
<th>Memory aids used to meet this goal</th>
</tr>
</thead>
</table>
| To remember daily tasks (e.g. daily walk, morning routine)                                | 35                                            | Dry wipe message board (with GMT and/or push button alarm, day/date clock)  
Filofax or diary (with GMT and/or alarm)  
Notepad/book  
Mobile phone or smart phone (e.g. iPhone)  
Talking watch or clock  
Routine  
Post it notes                                                                                                                                 |
| To find belongings within the house (n=30)                                                | 30                                            | Door organiser  
Set places with labels or desk organisers  
Smart Finders  
Key Ringers  
Cords for glasses  
Anxiety management strategies                                                                                                                                 |
| To remember what I have been told, including conversations                                | 21                                            | Filofax or notebook  
Message board  
Post it notes  
Internal strategies (e.g. chunking, controlling flow of information, questions, anxiety management)  
Voice recorder (e.g. iMemo)                                                                                                                                 |
| To remember future plans (e.g. appointments, to send a birthday card)                    | 29                                            | Dry wipe message board (with Goal Management Training [GMT] and/or push button alarm, day/date clock)  
Filofax or diary (with GMT and/or alarm)  
Notepad/book  
Mobile phone or smart phone (e.g. iPhone)                                                                                                                                 |
<table>
<thead>
<tr>
<th>Goal identified at baseline</th>
<th>Number of participants who nominated this goal</th>
<th>Memory aids used to meet this goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medication management</td>
<td>19</td>
<td>Medication Manager</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medication box with an alarm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dosette box</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Digital watch with alarm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Routine</td>
</tr>
<tr>
<td>To remember recent events (e.g. what I did last weekend)</td>
<td>14</td>
<td>Diary/ Filofax</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Expanded rehearsal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Routine</td>
</tr>
<tr>
<td>To remember names</td>
<td>12</td>
<td>Internal strategies (mnemonics, associations)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Confidence strategies (asking for information)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Talking photo album</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Direct retraining</td>
</tr>
<tr>
<td>To remember to lock windows/doors or turn off the iron/bath/lights</td>
<td>9</td>
<td>Memo Minder</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Voice recorder (e.g. iMemo)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Written labels at door</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Customised bath plug</td>
</tr>
<tr>
<td>To use the cooker safely</td>
<td>8</td>
<td>Kitchen timer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Memo Minder</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kitchen timer with spoken reminder</td>
</tr>
<tr>
<td>To not have to go back and check that I have done something</td>
<td>7</td>
<td>Filofax</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Voice recorder (e.g. iMemo)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Recorder on smart phone</td>
</tr>
<tr>
<td>Goal identified at baseline</td>
<td>Number of participants who nominated this goal</td>
<td>Memory aids used to meet this goal</td>
</tr>
<tr>
<td>-----------------------------------------------------------------</td>
<td>-----------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>To find the words I want to use</td>
<td>7</td>
<td>Internal strategies (e.g. association)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Circumlocution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Notebooks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Anxiety management</td>
</tr>
<tr>
<td>To find my way</td>
<td>7</td>
<td>Sat Nav</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Smart phone- Google maps/GPS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Filofax with map</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Problem solving training</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Internal strategies (sub vocalisation, landmarks)</td>
</tr>
<tr>
<td>To remember to take things with me as I leave (e.g. keys, phone, bus pass, medication)</td>
<td>6</td>
<td>Memo minder</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Car activated reminder</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Written labels at door</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Internal strategy- “Look before I leave”</td>
</tr>
<tr>
<td>To be more organised, including using memory aids more effectively</td>
<td>6</td>
<td>Message board (with push button alarm, GMT)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Filofax</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mobile phone or smart phone</td>
</tr>
<tr>
<td>To remember what I have read</td>
<td>6</td>
<td>Voice recorder</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Internal strategies (e.g. PQRST)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Highlighter pens/post it tabs</td>
</tr>
<tr>
<td>To pass on (phone) messages</td>
<td>6</td>
<td>Phone message post it notes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Written checklist</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Message board</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Voice recorder</td>
</tr>
<tr>
<td>To feel more confident</td>
<td>5</td>
<td><em>In situ</em> anxiety management strategies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GMT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Feedback and information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Behavioural experiments</td>
</tr>
<tr>
<td>Goal identified at baseline</td>
<td>Number of participants who nominated this goal</td>
<td>Memory aids used to meet this goal</td>
</tr>
<tr>
<td>-----------------------------------------------------------------</td>
<td>-----------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>To remember remote events (e.g. family holidays)</td>
<td>3</td>
<td>Cognitive behavioural therapy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Individualised journal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Talking photo album</td>
</tr>
<tr>
<td>To remember what I need to buy when shopping</td>
<td>3</td>
<td>Post it lists</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Message board</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diary/notebook/Filofax</td>
</tr>
<tr>
<td>To keep track of tasks</td>
<td>2</td>
<td>GMT with push button alarm or mobile phone alarm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Memo Minder</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Timer with or without voice reminder</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Voice recorder</td>
</tr>
<tr>
<td>To remember what I went downstairs for</td>
<td>2</td>
<td>Voice recorder</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Internal strategies (rehearsal)</td>
</tr>
<tr>
<td>To remember to use my hearing aid</td>
<td>1</td>
<td>Written checklist/reminders</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Routine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Set place</td>
</tr>
<tr>
<td>To remember to cross the road safely</td>
<td>1</td>
<td>Goal Management Training</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Internal strategies</td>
</tr>
<tr>
<td>To find where I parked my car</td>
<td>1</td>
<td>Voice recorder</td>
</tr>
</tbody>
</table>

85
The training protocols consisted of a description of key components and functions of each memory aid, in addition to in session exercises and homework assignments. Importantly, a list of training questions was devised for each memory aid to facilitate understanding of components and application of memory aids functions. Application questions included a question about what the memory aid was used for, which directly referred to the participant’s goals for the Memory Aids Clinic. Other application questions included where the memory aid was to be kept, how the participant would remember to use the memory aid, and how to review the use of the memory aid. A table of the training questions was produced for each memory aid with the headings: demonstration, Trial 1, Trial 2, Trial 3 and comments made by the clinical neuropsychologist to reflect how each memory aid was trained.

Training was conducted with the use of the protocols and with consideration of the participant’s cognitive profile. The training protocol formed the starting point for providing knowledge and training in the use of the memory aid (see Appendix 4 for examples of training protocols). Once the memory aid was selected, training began with a verbal description of the memory aid, its components and uses in relation to the participant’s goals. The use of the memory aid was then demonstrated to the participant. The participant then answered each training question or physically demonstrated use of the memory aid across three trials. They were encouraged not to guess if they did not know how to use the memory aid or if they did not know the correct answer to the training question. Knowledge of the components and of the
application of the memory aid was completed after three correct trials. Correct responses did not have to be verbatim repetitions of the information provided.

If the participant had difficulty learning how to use the memory aid with the use of the training protocol, training focussed on the use of environmental supports and the participant’s support network instead. For example, if a participant had difficulty learning to use a message board independently, his or her support network was enlisted to write messages on the board and ensure that the board was located in a prominent position within the participant’s home environment. The support network was also enlisted to facilitate correct referencing of the message board, including completion of compliance measures (see below), with the assumption that prompting could be faded over time.

If a participant’s severity of cognitive impairment precluded the use of the training protocol, the memory aid could be programmed for the participant, thus reducing the demands on the participant. In addition, if the participant failed the learning trials of the training protocol, the technique of spaced retrieval was used to learn auditory or written presentation of an instruction. For example, when learning to use a key location device, the participant was taught the sequence of pressing a central base to activate a radio alarm that had been attached to their keys. If the subject had difficulty learning this sequence, he or she was shown how to activate the alarm and asked to copy the neuropsychologist immediately to ‘find your keys’. This instruction was repeated after an interval of 15 seconds and if the response was correct the interval was expanded to 30 seconds and so on until the procedure was correctly performed after a five minute interval. The participant was encouraged not to guess if he or she did not know how to find their keys. If the subject did not know, he or she was shown how to correctly use the key location device and then the previously successful interval was reinstated.

Some participants quickly learned to use memory aids and apply these new skills to their everyday life. These participants were offered a modified version of Goal Management Training (GMT; Levine et al., 2000) as a means of more effectively using their system of memory aids. This was typically offered once all goals had been matched to memory aids. Some participants were instructed in GMT to meet their
goals of employing their system of memory aids more effectively. GMT consists of structured group exercises to encourage clients with acquired brain injury to monitor everyday performance, evaluate strategy use and to implement new strategies (Levine et al., 2000). Fish and colleagues (2006) employed a modified version of GMT to cue an executive review of performance on a ‘real life’ prospective memory task with the mnemonic STOP: to Stop what they were doing; to Think about their memory aids and what they are trying to do, to Organise what they have to do and within what time frame and to Plan their next activity whether it is to continue what they were doing or switch task. The cue was sent via a text message on a mobile phone and subjects were to review their goals when they received the message.

In the current study, participants were introduced to the concept of GMT in the context of why someone may forget to use their memory aid(s). For example, a participant may accurately write information in their diary, but then fail to refer to the diary. Participants were trained in the use of the mnemonic STOP as described by Fish et al (2006). However, in the Memory Aids Clinic participants were instructed to STOP and review their memory aid use. The aim of the review was to facilitate more effective and organised use of the memory aids, assuming that information about prospective memory tasks was correctly recorded. The review also aimed to increase co-ordination of memory aids, so that all possible sources of information were checked (e.g. a message board and a paper based diary). To complement the memory aid review, specific times throughout the day were identified, such as every two hours, three times a day etc. Memory aids with an auditory alarm were used to cue the review of memory aid. Again, the memory aid to cue goal review was chosen in collaboration with the participant, reflecting individual preferences, motor/sensory abilities and cognitive skills. Many participants were trained in the use of a small push button alarm, with memory aid review set at specific times throughout the day. Others used mobile phone alarms or a visual cue such as writing the mnemonic on their message board. Some participants elected to have automated text messages sent to their mobile phones to cue the memory aid review, using the online automated text messaging service (http://www.textanywhere.net). Spaced retrieval was used to train the association between the alarm and the mnemonic. Participants were asked what they had to do when the alarm rang (correct answer the STOP mnemonic) over increasing retention intervals.
Training of other memory strategies was conducted on a case by case basis. Two functional domains that did not easily lend themselves to the use of memory aids were face/name learning and remembering written material such as books. If a participant nominated remembering people’s faces and names as a goal, errorless learning techniques were used in conjunction with external memory aids. The participant was asked to provide photographs of the people he/she wanted to remember. Training stimuli were developed from these photographs by generating a mnemonic based upon a prominent facial feature and incorporating their name (see Dewar et al., 2009; Clare et al., 2000, 2002). The association between the photograph and the mnemonic/name was then trained using spaced retrieval. Learning of name/face association was supported by the use of a talking photo album (see Appendix 4). This device allowed a brief message (the mnemonic) to be recorded and subsequently played when viewing photographs to allow the participant to practise the face/name associations between sessions. The participant was trained in the use of the talking photo album following the specific training protocol developed for this aid following the outline described above.

Remembering written material, such as a book or magazine article, was another challenging goal since few external memory aids were available to support this activity. Participants were offered the rehearsal strategy of PQRST (Preview, Question, Read and State, see Wilson 2009 for a discussion). The procedure for PQRST is to Preview the material to be recalled, to ask key Questions about the text, to Read the material carefully to answer the questions, to State the answers and finally, to Test regularly for retention of information. Although it is not spontaneously used by many memory impaired people, this technique has been shown to improve recall of short passages (Wilson, 2009) and books (Miotto et al., 2007) when the subject is prompted with questions about the material. Within the Memory Aids Clinic, some clients were instructed in the PQRST technique, practising with short passages and newspaper articles within sessions. Other clients were not interested in this somewhat laborious, artificial reading technique and opted for the use of a voice recorder to summarise key points from written material. Case study JG in Chapter 5 provides more detail on the use of a voice recorder to remember what she had read.
One memory aid was introduced at a time. The decision of which memory aid to use at the beginning of training was a collaborative decision. When the participant demonstrated successful skills acquisition and knowledge of how to apply this memory aid with correct responses to training questions, the next Memory Aids Clinic goal was addressed by introduction of new memory aids or strategies. Mastery of memory aids was reviewed with the use of the training questions at subsequent sessions. Thus, the initial and second sessions focused on training memory aids to meet functional goals. In the third session, the emphasis of memory aids training shifted focus towards use of the aids in novel situations with the discussion of hypothetical situations and feedback about memory aid use in everyday life outside of sessions. This was facilitated by in-session exercises specific to each memory aid and discussions of alternative uses of each memory aid.

Participants were given homework assignments at the end of every session to facilitate application of memory aid use in the home environment and to indirectly facilitate adaptation of memory aid use to different situations and settings. Compliance assessments formed the bulk of homework assignments. A compliance measure was developed for each memory aid to ensure that the memory aid was being put into practice between sessions. The compliance measure was specific to each memory aid but typically involved a pen and paper checklist to record when the memory aid was used and to note any difficulties. For example, to measure compliance when using a message board, participants were given a week to a page checklist with the instructions to record when they looked at the message board at regular times. Other compliance measures included a review of diary entries or photographs of how memory aids were established within the home environment. Participants were asked to keep the compliance measure in a prominent location and carers were enlisted to ensure completion of this task. In addition to compliance measures, homework assignments included prospective memory tasks such as bringing a list of medications, photographs or sending an email on a specific date to record use of memory aids. As noted previously, at the end of every session participants were given a written summary of the session, including any homework assignments.
The main focus of the Memory Aids Clinic was training in the systematic use of memory aids to meet functional everyday memory goals. A holistic approach was adopted within this cognitive rehabilitation program since issues such as confidence, insight and education needs were also monitored and addressed on a case-by-case basis. All participants received feedback about their baseline neuropsychological assessment results in combination with education about the role of memory aids in rehabilitation and recovery from acquired memory impairment. Emphasis was placed on the compensatory nature of memory aids as opposed to an attempt to restore lost memory function.

Impaired awareness of memory impairments or poor insight into the potential impact of memory impairments on everyday function did sometimes emerge as a potential barrier to treatment. Effort was made to establish a good rapport with the participant to ensure that they felt comfortable within the therapeutic setting. In these circumstances, the use of memory aids was introduced as part of a mutual exploration of possibilities (Gracey et al., 2009) to consider the impact of memory problems and to reflect on day to day memory function. ‘Behavioural experiments’ (McGrath & King, 2004) were developed to explore the efficacy of various strategies and to foster greater independence. For example, if a participant expressed a lack of confidence in the use of a medication box, a behavioural experiment was established such that for one week the participant relied upon their partner to administer medication and in the second week, they were to use the medication box. A compliance record form was constructed to note attitudes towards the memory aid during this period. Then, in the treatment session, the feelings and outcome of these two approaches was considered with respect to the Memory Aids Clinic goals. Similarly, if a participant felt that they did not need to use a diary to remember appointments or conversations, they may have been given four verbal instructions (to send an email, for example) for their homework, only two of which were recorded using a memory aid. Again, task outcome was reflected upon in the next session with an exploration of what the performance level meant for the participant and their memory goals. Other behavioural experiments took the form of surveys to investigate whether memory aids such as a diary or smart phone were common place.
Within a holistic, collaborative rehabilitation model, some participants suggested goals that addressed confidence, self-efficacy or anxiety in the performance of everyday memory tasks. For example, some participants expressed low self-confidence in their ability to perform their usual activities due to their memory problems or described a degree of worry associated with forgetting, such as having to go back and check whether they had locked the door or turned off electrical equipment such as the iron or stove. Some participants may have successfully adopted memory aids to compensate for their memory difficulties but experienced increased self-consciousness or feelings of low self-efficacy when using these new techniques. A further subset of participants described symptoms of anxiety which compromised their use of instructed memory aids and strategies. In these situations, cognitive behavioural techniques were applied on a case-by-case basis including education about the role of anxiety and in situ behavioural techniques such as breathing or distraction (Andrews et al., 1994), and the use of behavioural experiments to improve feelings of mastery of memory aids and general self-efficacy (McGrath & King, 2004). Rehabilitation was offered with consideration of the impact of an acquired memory disorder or diagnosis of a progressive condition on an individual’s sense of self and the participant’s psychosocial adjustment following brain injury (see Gracey et al., 2009).

In the treatment group, at the end of the third training session, the Problem Solving Inventory was re-administered. Functional goal attainment was also re-assessed. Subjects in the treatment group were asked to record each day whether the goal was achieved with a Yes/No or tick/cross response. The diary was to be completed for 10 days and formed the end-of-training measure for functional goal attainment. Participants were given a stamped-addressed envelope to return the diary once completed. They were offered an automated text reminder to aid completion of the diary if they were unable to suggest an appropriate memory strategy for this task. Telephone reminders were made to chase delayed returns.

2.5.3 Follow-Up Session:
Twelve weeks after the end of training, participants in the treatment group underwent a review neuropsychological assessment of up to three hours. Participants in the control group underwent a review neuropsychological assessment approximately 18
weeks after their initial assessment. A functional goal attainment diary was sent to all participants with the appointment letter for the review assessment. Again, the diary was to be completed for 10 days. Participants were asked to record each day whether the goal had been attained and to bring the completed diary to the review appointment. If the participants did not bring the completed diary to the session, they were given another diary to complete and a stamped addressed envelope in which to return it. For control subjects, the follow-up diary was to be completed before treatment began.

The review assessment comprised a clinical interview which gathered information on current subjective cognitive complaints and mental state. For the treatment group, use of supplied memory aids was reviewed, including discussion about any problems with the memory aids. Barriers to use of memory aids and awareness of memory problems were explored. Medications and everyday activities were reviewed, with a focus on any change since the initial assessment. The interview was conducted with the participant and an informant (partner, other family member or carer) when available.

The order of administration of the review neuropsychological test battery was as follows:

1. Subjective Rating of Memory Performance
2. Rivermead Behavioural Memory Test- Extended Version 2
3. Digit Symbol (WAIS-III),
4. Elevator Counting (TEA) Version B
5. Telephone Search (TEA) Version B
6. Telephone Search while Counting (TEA) Version B
7. Zoo Map (BADS)
8. Letter Number Sequencing (WAIS-III),
9. Brixton Spatial Anticipation Test
10. Cambridge Prospective Memory Test (Version B)
11. Beck Depression Inventory-II
12. Prospective Retrospective Memory Questionnaire
13. Rosenberg Self Esteem Scale
14. Community Integration Questionnaire
15. Problem Solving Inventory
Note that the WASI and NART-R were not re-administered at the review assessment. Informants again completed the Carer Strain Index and the informant’s version of the Prospective and Retrospective Memory Questionnaire whilst waiting for the assessment to be completed. If the participant attended the review assessment alone, they were asked to give these two questionnaires to someone who knew them well and to return the completed questionnaires in the stamped-addressed envelope provided.

2.6 Analysis
The primary outcome measure was functional goal attainment as measured by the memory performance diary. There were a number of secondary outcome measures. These were neuropsychological test performance, responses on psychosocial questionnaires and responses on the Problem Solving Inventory. A comparison was made between the treatment and control group performance on each of these measures.

The main dependent variable in this study was the change in functional goal attainment as measured by the memory performance diary across the time points of baseline, end of treatment and follow-up. Between group analysis was conducted on the percentage of treatment goals attained at each of these time points. A two way repeated measures ANOVA was conducted with the variables of time and group. Independent t tests were then conducted across groups at baseline, at the end of training (six weeks after baseline) and at follow-up. Individual analysis of functional goal attainment was conducted with a Reliable Change Index for each participant across the time periods of baseline to end of training; baseline to follow-up and end of training to follow-up. A chi square analysis was then conducted to investigate whether the proportion of participants who changed across these time periods differed between the treatment and control group.

Regression analysis was conducted to investigate determinants of successful functional goal attainment. On the basis of previous studies (Evans et al., 2003), the contribution of baseline memory, attention/concentration and executive function to
successful goal outcome was explored. The impact of premorbid use of aids, age, education, insight and social support on success was also investigated.

Performance on the memory performance diary of subjects with a progressive condition and those with a non-progressive condition was compared with a two way repeated measures ANOVA with the factors of time and group. Comparisons were made between participants with a progressive condition, across both treatment and control groups, across the time periods of baseline, end of training and follow-up. Similarly, comparisons were between treatment and control group participants with a non-progressive condition across baseline, and of treatment and follow-up.

The effect of treatment in the Memory Aids Clinic upon performance on neuropsychological measures was examined by repeated measures ANOVA of GROUP (treatment or control) across TIME (baseline or follow-up). Given the large number of comparisons, a Sidak correction was applied to control the Type I error rate (Field, 2005).

Similarly, the effect of treatment in the Memory Aids Clinic on the psychosocial measures or mood, self-esteem, community integration, carer strain and subjective report of memory function was examined with a repeated measures ANOVA of GROUP (treatment or control) across TIME (baseline or follow-up). Again a Sidak correction was applied to control the Type I error rate (Field, 2005).

The Problem Solving Inventory was used to measure generalization of memory aid use to everyday life. Change in this measure was examined with GROUP (treatment or control) by TIME (baseline or follow-up) repeated measures ANOVA. Responses on the Problem Solving Inventory according to disease course were also analyzed with the use of independent t tests. Comparisons were made between treatment and control group participants with a non-progressive condition across baseline and follow-up and then treatment and control participants with a progressive condition across baseline and follow-up.
3 RESULTS - Overall comparison of treatment and control groups

3.1 Introduction
There is growing support for the use of both low and high technology memory aids in the rehabilitation of both progressive and non-progressive brain injury and illness. However, due to memory and additional cognitive impairments it may be difficult for people with brain injury and illness to effectively use memory aids to improve their everyday function, sense of well-being and participation. There is a need for more information on how to help people with acquired memory problems to use memory aids in day to day life. A systematic approach to training has been suggested (Sohlberg & Mateer, 1989; Sohlberg & Turkstra, 2011) as reviewed in detail in section 1.5.1. Following task analysis, this approach advocates the acquisition of specific skills to use a memory aid before successfully applying and adapting/generalising use to the home, work or social environment. On this basis, the Memory Aids Clinic aimed to provide specialised training in the use of memory aids to support everyday functioning and thus add to the literature on how to train people with memory impairments to use memory aids.

Cognitive, including memory, rehabilitation research has been plagued by a number of methodological challenges, including how to measure outcome. As one of the aims of rehabilitation is to help people achieve personal goals (Wilson, 2009), attainment (outcome) needs to be measured. Goals within cognitive rehabilitation programs are set collaboratively and so inform the direction of treatment, act to motivate the client, and enhance communication between the client and treating clinician. However, this leads to the difficulty of how to measure outcome of a heterogeneous collection of goals. Clinical research and practice no longer measures outcome by improved performance on neuropsychological tests rather, with consideration of the WHO ICF model (2001), rehabilitation outcomes now focus on the effect of an intervention on an individual’s ability to execute everyday activities and participate within their personal and social environment. Gillespie and colleagues (2012) acknowledge the ICF framework with their conceptualisation of assistive technology for cognition in terms of functionality. Similarly, intervention in the Memory Aids Clinic was aimed at everyday memory function as defined by personal goals as opposed to the
evaluation of a particular memory aid or performance on neuropsychological tests. The effect on participation was also examined directly through the administration of psychosocial questionnaires. However, as it has been suggested that memory aids need to be carefully matched to an individual’s cognitive profile and everyday goals (Evans et al., 2003) and training needs will also be dictated by cognitive profile (Wilson & Watson, 1996; Elhardt et al., 2008), neuropsychological assessment was also included in the current study.

The results will be presented across three chapters. The first chapter (Chapter 3) will provide a general overview of the outcome of training in the Memory Aids Clinic, with a comparison between the treatment group and the waiting list control group. The second chapter (Chapter 4) will compare the outcome of subjects with a non-progressive neurological condition to those with a progressive condition. Finally, the effects of training in the Memory Aids Clinic will be illustrated by the presentation of a case series of subjects with either a non-progressive (Chapter 5) or progressive condition (Chapter 6).

A number of outcome measures were used to evaluate the effect of training in the Memory Aids Clinic. For a full explanation of measures, refer to section 2.4. These measures were:

1. Functional goal attainment as measured by the everyday memory diary. This goal attainment diary was scored by recording the number of days a goal was successfully performed relative to the number of days in which performance on that goal was recorded, so as to achieve a proportion of goal attainment. A percentage reflecting successful attainment was calculated for each goal. An exploratory analysis was also conducted to compare the characteristics of participants who completed the diary to those participants who did not complete the diary.

2. Neuropsychological test performance with tests scored according to clinical manuals

3. Psychosocial questionnaire responses, also scored according to clinical manuals or published data
4. Responses on the Problem Solving Inventory, which were scored according to the overall number of strategies listed and also the number of different strategies listed.

3.2 Participants: Demographics and clinical characteristics at baseline

Performance of all subjects on the memory diary was visually inspected prior to data analysis. If performance on the memory diary was at floor, participants were to be excluded, since such severe everyday memory function was suggestive of global cognitive impairment and poor suitability for use of memory aids to manage everyday problems (Evans et al., 2003; Wilson & Watson, 1996). Participants who did not report everyday memory problems on the diary were also to be excluded from the analysis of the diary performance, since this suggested minimal room for improvement or impaired insight into memory performance. Visual inspection revealed a number of outliers on the basis of these criteria. Three participants had a baseline memory performance of less than one percent goal attainment and were excluded from the analysis. These three subjects were all in the control group. Two had a progressive condition with a diagnosis of probable Alzheimer’s disease and one had a non-progressive condition with a history of Korsakoff’s syndrome. These three patients had severe and generalised impairment on neuropsychological assessment and demonstrated poor insight into their memory difficulties. Goals had been set with their carers/family members and the validity of the diary entries was questionable given the report of their carers. Four subjects in the treatment group who reported baseline memory diary performance of greater than 95 percent were excluded on the basis that this was deemed to reflect an absence of everyday memory difficulties in the identified functional goal domain. Two of these participants had a progressive condition (probable AD) and two had a non-progressive condition (one patient had a vascular diagnosis and the other patient had HIV-related cognitive impairment). Therefore, 92 percent of treatment and control participants who completed the training protocol were included in the final analysis.

Clinical demographics of the treatment and control group following removal of outliers are listed in Table 4. There were 59 subjects in the treatment group. In the treatment group, as seen in Table 5, there was a ratio of 33 men to 26 women. There
were 42 subjects with a non-progressive neurological condition and 17 subjects with a progressive neurological condition. The average age of the participants in the treatment group was 52.5 years (S.D.=13.5). The treatment group participants had on average completed 12.6 years (S.D.=3.3) of education. Treatment subjects used an average of 6.3 (S.D.=2.2) memory aids at the time of referral to the Memory Aids Clinic. These included items such as calendars, diaries, notes, lists, medication boxes and mobile phones alarms. Premorbid IQ was estimated at 103.3 (S.D.=14.9) on the basis of performance on either the National Adult Reading Test Second Edition (Nelson, 1991) or the Wechsler Test of Adult Reading (Wechsler, 2001). At baseline, subjects in the treatment group had a profile score of 18.6 (S.D.= 9.4) which is at the cut-off for impaired and poor performance on the Rivermead Behavioural Memory Test Extended version (Wilson et al., 1999). On the Beck Depression Inventory II (Beck et al., 1996), subjects in the treatment group had a score of 14.8 (S.D.=10.3) indicating a mild degree of depressive symptomatology (clinical cut off 14-19).

Table 4: Sample characteristics of participants at baseline assessment

<table>
<thead>
<tr>
<th></th>
<th>Treatment Group (n= 59)</th>
<th>Control Group (n = 21)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (S.D.)</td>
<td>Range</td>
</tr>
<tr>
<td>Age, years</td>
<td>52.5 (13.5)</td>
<td>21-81</td>
</tr>
<tr>
<td>Education, years</td>
<td>12.6 (3.3)</td>
<td>8-23</td>
</tr>
<tr>
<td>Number of memory aids</td>
<td>6.3 (2.3)</td>
<td>2-13</td>
</tr>
<tr>
<td>Estimated Premorbid IQ</td>
<td>103.3 (14.9)</td>
<td>67-127</td>
</tr>
<tr>
<td>RBMT-E Profile Score</td>
<td>18.6 (9.4)</td>
<td>2-50</td>
</tr>
<tr>
<td>BDI-2</td>
<td>14.8 (10.3)</td>
<td>0-43</td>
</tr>
</tbody>
</table>


In the control group, there were 21 subjects. Table 4 contains details about the age, education and number of memory aids used by the control subjects in addition to performance on tests of premorbid intellectual functioning, memory and mood. There were near significant differences between the treatment (n=59) and control group
(n=21) in terms of scores on the BDI II (t = -1.89, p = 0.06) and performance on the RBMT-E (t = 1.84, p = 0.07). There were no significant differences in terms of age (t = -1.74, p = 0.90) or number of years of education (t = 1.46, p = 0.15) There was no significant difference in the ratio of males to females ($\chi^2 = 1.06, p = 0.30$) or progressive to non-progressive condition ($\chi^2 = 0.62, p = 0.43$) across the treatment and control groups.

**Table 5: Gender and Disease course characteristics of participants**

<table>
<thead>
<tr>
<th></th>
<th>Treatment Group (n = 59)</th>
<th>Control Group (n = 21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (M:F)</td>
<td>33:26</td>
<td>9:12</td>
</tr>
<tr>
<td>Disease course</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(non-progressive:</td>
<td>42:17</td>
<td>13:8</td>
</tr>
<tr>
<td>progressive)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend: M = Male, F = female.

As noted in chapter two, 12 control group participants and nine control group participants did not complete treatment following the baseline assessment. The baseline performance of these subjects was compared to respective treatment and control participants who completed treatment to explore any reasons for treatment drop out. The comparison was made with independent t tests using a 0.05 level of significance. In comparison to the treatment participants that completed the rehabilitation program, treatment participants who discontinued had a lower level of education (t = 6.29, p < 0.01) and were more depressed as measured by the BDI II (t = -2.05, p = 0.05). There were no significant differences in terms of baseline memory performance on the RBMT-E, age, estimated premorbid IQ or number of memory aids used premorbidly. There was no significant difference in the gender or disease course of treatment participants who completed the treatment compared to those who discontinued. In the examination of the control participants who dropped out of treatment, control subjects who remained in the Memory Aids Clinic used a greater number of memory aids at baseline compared to those who discontinued (t = 2.20, p = 0.04). There were no differences in age, years of education, estimated premorbid IQ, baseline memory performance or level of depression between control subjects who continued compared to those who discontinued treatment. In addition, there was no
significant difference in the gender or disease progression of control subjects who completed treatment to those that dropped out of the clinic.

3.3 Treatment outcome as measured by memory diary
The main outcome measure in the Memory Aids Clinic was the memory diary (see 2.4.1). Goal attainment was recorded in the memory diary across three time points (baseline, end of training, follow-up). At each time point, a participant recorded whether or not they had achieved a goal (target behaviour) across a set number of days. This yielded a proportion of days the goal was achieved out of the number of days noted in the diary, for example successfully remembering to take medication on time for five out of a possible seven days. This proportion sometimes differed across goals within participants (for example, attainment of medication compliance at five out of seven days and remembering to turn off the stove on six out of eight occasions) and across individuals. Differences in the possible occurrence of goal attainment occurred within subjects due to the different frequency of some behaviours, e.g. attending appointments on some days versus taking daily medication. The proportion of targets was pooled for each individual to reflect the percentage of targets achieved at baseline, end of training and at follow-up.

Performance on the memory diary was analysed at both the group and individual level. Group analysis compared performance of the treatment and control groups across the three time points of baseline, end of training (six weeks after baseline) and follow-up (18 weeks after the end of treatment) to determine the effects of treatment in the Memory Aids Clinic on everyday memory function. Data were then analysed at an individual level using the Reliable Change Index (RCI) to determine significant change over time.

The Reliable Change Index is an indicator of the probability that an observed difference between two scores from the same participant on the same test cannot be attributed to measurement error (Jacobson & Truax, 1991; Spreen et al., 2006). When there is a low probability that the observed change is due to measurement error, then one can infer that it reflects other factors - in this case, a treatment effect. The methodology of the RCI is based on the assumption that the level of functioning of the experimental population subsequent to treatment should place the patient closer to
the mean of a normal population than to the mean of a dysfunctional patient population (Jacobson & Truax., 1991). The primary measure of interest in calculating the RCI is the Standard Error of Difference (SED) which describes the spread of distribution scores that is expected when no actual change occurs. Based on the control population, the SED is calculated as follows:

\[ SED = \sqrt{\frac{2}{n}} \times SEM^2 \]

Where \( SEM \) (the Standard Error of Measurement) = \( SD\sqrt{1 - r} \)
And where \( r = \text{the reliability coefficient of the test.} \)

The RCI for a specific score is then calculated by dividing the observed amount of change by the SED using the following formula:

\[ \frac{S_2 - S_1}{SED} \]

Where \( S_1 = \text{a participant's initial test score} \)
And where \( S_2 = \text{a participant's score on the same measure at retest.} \)

The RCI can then be thought of as a type of z score (Spreen et al., 2006), such that a score falling outside a range of -1.96 to 1.96 would be expected to occur less than five percent of the time due to measurement error. The RCI works well if adequate norms are available for the population of interest, and more specifically if there is existence of adequate internal reliability. As the memory diary was a record of memory everyday performance developed for the current study, an estimated reliability coefficient of 0.85 was assumed on the basis of findings for established everyday memory questionnaires (e.g. Everyday Memory Questionnaire, Sunderland et al., 1983; Royle & Lincoln, 2008).

### 3.3.1 Group analysis of the memory diary

Missing value analysis indicated that greater than ten percent of data from the memory performance diaries were missing for both the treatment (n = 59) and control groups (n = 21) after exclusion of outliers, across each of the three time periods (baseline, end of treatment and follow-up). However, as this is the key outcome variable designed for this study missing data were excluded on a case by case basis.
The issue of compliance with completion of the memory performance diary is the subject of a subsequent analysis, described below.

A two way repeated measures ANOVA was conducted with the factors of time (baseline, end of training and follow-up) and group (treatment or control group) to examine the effects of treatment in the Memory Aids Clinic on attainment of everyday memory goals. Comparison of the memory performance diary between the treatment and control group across baseline, end of training and follow-up is shown in Figure 3.

Only 34 subjects in the treatment group and ten subjects in the control group were available for comparison across all three time points. There was a significant effect of time as performance on the memory performance diary improved for both groups $F(2, 84) = 9.94, p<0.01$. There was no significant effect of group $F(1, 42) = 0.27, p=0.61$ and no significant interaction between time and group $F(2, 84) = 1.45, p = 0.24$.

As greater than ten percent of memory diary data was missing and a large proportion of data was lost when a repeated measures ANOVA was conducted across the three time points, separate two way repeated measures ANOVAs were conducted between the treatment and control group across the time points of baseline and end of training, baseline and follow-up, and the end of training and follow-up. In the comparison of baseline to the end of training, 41 treatment subjects were included and compared to ten control subjects. There was a significant effect of time as both groups improved their memory diary performance $F(1, 49) = 15.26, p <0.01$. However, there was no significant effect of group $F(1, 49) = 0.8, p = 0.78$ and no significant group by time interaction $F(1, 49) = 1.48, p= 0.23$.

From baseline to the follow-up period, the performance of 44 treatment subjects was compared to 13 control subjects. There was a significant effect of time $F (1, 55) = 8.93, p<0.01$. There was no significant effect of group $F (1, 55) = 1.62, p = 0.21$. However, there was a significant group by time interaction $F (1, 55) = 3.93, p= 0.05$. Inspection of average goal attainment across groups at these time points indicates that improved performance of the treatment group subjects was maintained across time compared to a drop off in performance of the control group.
From the end of training to follow-up period, comparison was made between 34 treatment subjects and eleven control subjects. There was no significant effect of time $F(1, 43) = 2.56, p = 0.12$ or group $F(1, 43) = 0.78, p = 0.38$. There was no significant group by time interaction $F(1, 43) = 0.01, p = 0.98$.

**Figure 3: Memory performance diary ratings of treatment and control subjects across baseline end of training and follow-up.**

Finally, comparison of goal attainment between groups (treatment and control) at different time points in the treatment program (baseline, end of training and follow-up) was examined with an independent t test analysis (two tailed). At baseline, there were 53 treatment subjects and 15 control subject data sets available for analysis. There was no significant difference in goal attainment between the treatment (mean = 50.8, S.D. = 20.5) and control groups (mean = 43.1, S.D. =18.7) at baseline $[t (66) = 1.31, p= 1.93]$.

At the end of training, data sets were available for 42 treatment subjects and 11 controls. There was no significant difference in goal attainment between the treatment
At follow-up, data sets were available for 44 treatment subjects and 14 control subjects. There was a significant difference in goal attainment between groups \([t (56) = 2.99, p <0.01]\). Goal attainment was higher in the treatment group (mean = 67.1, S.D. 23.7) relative to the control group (mean = 50.4, S.D. = 16.1).

To strengthen the argument that the difference between groups at follow-up was not an artefact of differences in goal attainment at baseline, comparison of the memory performance diary between the treatment and control group across baseline, end of training and follow-up was repeated with a t-test analysis using a subgroup of subjects more closely matched on baseline memory diary performance. The results are shown in Figure 4. Subjects with a baseline memory diary performance of less than 23 percent or greater than 76 percent were excluded. The pattern of findings was the same for this subgroup. At baseline, there were 43 treatment subjects and 14 control subject data sets available for analysis. There was no significant difference in goal attainment between the treatment (mean = 51.8, S.D. = 13.6) and control groups (mean = 44.7, S.D. 18.2) at baseline \([t (55) = 1.56, p= 0.124]\). At the end of training in this subgroup analysis, data sets were available for 32 treatment subjects and 11 controls. There was no significant difference in goal attainment between the treatment (mean= 73.7, S.D. 18.2) and control groups (mean = 62.5, S.D. = 27.9) \([t (41) = 1.51, p = 0.14]\). At follow-up, data sets were available for 37 treatment subjects and 14 control subjects. There was a significant difference in goal attainment between groups \([t (49) = 2.99, p <0.01]\). Goal attainment was again higher in the treatment group (mean = 69.3, S.D. 21.5) relative to the control group (mean = 50.4, S.D. = 16.1).
Figure 4: Memory performance diary ratings of treatment and control subjects across baseline, end of training and follow-up for a subgroup with goal attainment greater than 23 but less than 76 percent at baseline.

3.3.2 Individual analysis of the memory diary

From the control data, a Reliable Change Index (RCI) was calculated for each participant. As noted above, the RCI was deemed to reflect a significant improvement if the value was 1.96 or greater and to reflect no change if the RCI is less than 1.96. Inspection of raw scores then determined whether a significant change reflected an improvement across time or deterioration. The RCI scores were used to classify participants into three groups of improved, same or worse across the three time comparisons of baseline to end of training, baseline to follow-up and end of training to follow-up. A Fishers Exact Test was then conducted to investigate whether the proportion of participants who changed across time periods differed between the treatment and control groups.

From baseline to the end of training, 51 percent (n = 22/43) of participants in the treatment group had improved everyday memory performance as measured by the diary compared to 50 percent (n = 5/10) of control participants. Across this period, goal attainment of 42 percent (n = 18/43) of treatment group participants and 40
percent (n = 4/10) control group participants stayed at the same level. There was no significant association between change from baseline to the end of training and group (p = 1.0, Fisher exact test) in a similar pattern to the group analysis.

From baseline to the follow-up assessment, within the treatment group, 39 percent (n = 18/46) of the treatment group had improved relative to 29 percent (n = 4/14) of the control group. Fifty two percent (n = 24/46) of the treatment group and 71 percent (n = 10/14) of the control group stayed the same. Nine percent (n = 4/46) of the treatment group deteriorated across this time period. There was no significant association between group and change in everyday memory function across baseline to follow-up (p = 0.55, Fisher exact test).

From the end of training to the follow-up assessment, 27 percent (n = 3/11) of control participants improved performance whereas only three percent (n = 1/35) of treatment group participants improved across this time period. However, 77 percent (n = 27/35) of treatment subjects maintained their performance to remain at the same level from the end of training to the follow-up period, compared to 36 percent (n = 4/11) of control subjects. Twenty percent (n = 7/35) of treatment subjects and 36 percent (n = 4/11) of control subjects deteriorated across this time period. There was a significant association between group and change in everyday memory function across this time period (p = 0.01, Fisher exact test). This pattern of performance indicates that goal attainment was maintained in the treatment group.

### 3.3.3 Prediction of improved everyday memory performance from baseline to follow-up.

#### 3.3.3.1 Prediction of outcome from demographic variables

To explore subject characteristics that predicted improved everyday memory function at follow-up, regression analyses were conducted on the demographic variables of age, education and number of memory aids used at the time of referral. Relationships between predictor variables and outcome were only examined within the treatment group. Separate simple linear regression analyses were conducted with outcome defined according to either the RCI analysis as 1 = improved, 2 = same or 3 = worse
across the baseline to follow-up and the end of training to follow-up or the difference between goal attainment at baseline and goal attainment at follow-up.

Age, years of education and number of memory aids use at the time of referral did not predict outcome as defined by the RCI analysis or the difference score between baseline and follow-up. Prediction of outcome will be explored further in the subsequent analysis of subjects with a non-progressive or progressive neurological condition.

3.3.3.2 Prediction of outcome on basis of neuropsychological function.

To explore whether baseline neuropsychological function predicted outcome across the baseline to follow-up period, multiple regression analyses were conducted using memory, attention/concentration, and executive function as predictors entered in a forced entry method. Memory function grouped performance on the RBMT-E and the Camprompt. Attention and concentration function grouped performance on the TEA Elevator counting subtest, the TEA Telephone Search subtest, the TEA Telephone Search with Counting subtest, the WAIS III Letter Number Sequencing subtest and the WAIS III Digit Symbol subtest as predictors. Executive function reflected performance on the BADS Zoo Map test and the Brixton Spatial Anticipation test. Separate analyses were conducted within the treatment group defining outcome as either change on the memory performance diary from baseline to follow-up according to the Reliable Change Index analysis as 1 = improved, 2 = same or 3 = worse or according to the difference score of the memory performance diary across from baseline to follow-up.

Neuropsychological function at baseline within the domains of memory, attention/concentration and executive function did not predict outcome. There were no significant relationships between these predictor variables and outcome defined according reliable change from baseline to follow-up or when defined as the difference score of the memory performance diary from baseline to follow-up. Prediction of outcome on the basis of neuropsychological performance will be re-examined in the outcome comparison between subjects with a non-progressive or progressive neurological condition.
3.3.3.3 Prediction of outcome on basis of psychosocial function.

To explore whether baseline psychosocial function predicted outcome across the baseline to follow-up period, linear regression analyses were conducted using scores on measures of mood (Beck Depression Inventory II), self-esteem (Rosenberg Self Esteem measure), subjective memory reports (Prospective Retrospective Memory Questionnaire), participation (Community Integration Questionnaire) and carer strain (Carer Strain Index). As with the regression analyses described above, outcome was defined according to either the Reliable Change Index analysis as 1 = improved, 2 = same or 3 = worse or the difference score of the memory performance diary across from baseline to follow-up.

Psychosocial function at baseline did not predict outcome from baseline to follow-up regardless of whether outcome was defined in terms of reliable change across this period or the difference score on the memory performance diary.

3.3.4 Characteristics of diary completers vs. diary non-completers

Visual inspection of the data indicated that a number of subjects did not complete the memory diary. At baseline, across all subjects, 15.1 percent of diary data was missing; at the end of training 34.1 percent and at follow-up 28 percent. Thus comparison between time points was not available for all subjects who completed treatment in the Memory Aids Clinic. Poor compliance in completion of the memory diary has important clinical implications as it may indicate those subjects who need additional input to take part and then potentially benefit from treatment. An exploratory analysis was conducted to examine the characteristics of participants who completed the diary compared to those that did not complete the diary. A chi square analysis was conducted on the categorical variables of gender, group and disease course (progressive or non-progressive). There was no significant association between completing the diary and gender (X²(1) = 1.01, p = .32), disease course (X²(1) = .26, p = .60) or group (X²(1) = 1.29, p= 0.26).

The neuropsychological performance of diary completers compared to non-completers was explored with the use of independent t tests, with the error rate set at
0.01 due to the large number of comparisons. Performance on baseline measures of neuropsychological function was compared between diary completer and non-completers. There were no significant difference between participants who completed the diary and those who did not complete the diary on measures of general intellectual function: estimated full scale IQ \[t(60) = 0.18, p=0.86\], WAIS III or WASI \[t(56) = -0.03, p=0.98\]; memory function: RBMT-E \[t(71) = 0.06, p= 0.95\], Camprompt \[t(54) = 0.13, p= 0.90\]; information processing: WAIS III Letter Number Sequencing subtest \[t(63) = -1.97, p= 0.05\], WAIS III Digit Symbol \[t(68) = 0.51, p= 0.62\], Elevator Counting \[t(70) = -1.64, p= 0.11\], Telephone search \[t(65) = 0.91, p= 0.37\], Telephone Search with Counting \[t(61) = -0.51, p=0.62\]; or executive function: Zoo Map \[t(65)= 0.79, p=0.44\], Brixton Spatial Anticipation Test \[t(63) = -0.24, p= 0.81\].

There was a non-significant trend for participants who were compliant with completion of the diary to rate their memory as significantly worse at baseline than those who did not complete the diary \[t (71) = 2.34, p = 0.02\] on a self-report questionnaire developed for the current study. There were no significant differences on other subjective ratings of memory: stress \[t (71) = 1.06, p= 0.29\], home impact \[t (71) = 0.52, p= 0.60\], social impact \[t (71) = 0.99, p= 0.33\], or work impact \[t (21) = -0.01, p = 0.99\]. There were no significant differences between subjects who completed the diary and those that did not complete the diary on age at assessment \[t (71) = 0.55, p = 0.59\], number of years of education \[t (70) = 1.38, p= 0.17\], or the number of aids used premorbidly \[t (71) = 1.222 p= 0.23\].

Participants who completed the diary recorded poorer levels of community participation on the Community Integration Questionnaire at baseline than those who did not complete the diary \[t (76) = -2.59, p = 0.01\]. There were no differences on measures of mood (BDI II \[t (70) = -0.43, p= 0.67\]), self-esteem (Rosenberg \[t (71) = 1.40, p= =0.17\]), self-ratings of prospective or retrospective memory (Prospective Retrospective Memory Questionnaire \[t (70) = -0.79, p= 0.43\]) or carer strain (Carer Strain Index \[t (47) = -0.22, p = 0.83\]) between diary completers and non-completers.

There were no significant differences between subjects who completed the memory diary and non-completers on the Problem Solving Inventory in terms of the number of memory aids suggested \[t(57) = 0.60, p= 0.55\], the number of strategies suggested
[t(57) = 0.55, p= 0.58], or the number of different memory aids or strategies suggested [t(57) = 0.18, p= 0.86].

3.4 Missing data analysis
There was a significant amount of missing data in both the treatment and control data set for the neuropsychological, psychosocial and Problem Solving Inventory measures. Data were missing for both the baseline and follow-up assessments. In the treatment group, within the neuropsychological battery, the following tests had greater than ten percent of data missing at the follow-up testing session: Camprompt, WAIS III Digit Symbol, WAIS III Letter number (also at the baseline session), Elevator Counting, Telephone search, Telephone search with Counting (also at baseline), Zoo Map and the Brixton Spatial Anticipation Test. For the control group, within the neuropsychological battery, greater than ten percent of data missing was missing at both baseline and follow-up session for the Camprompt, WAIS III Digit Symbol, WAIS III Letter number sequencing, Telephone search, Telephone search with Counting, Zoo Map and Brixton Spatial Anticipation Test. Neuropsychological tests were not completed due to fatigue, an inability to see stimuli in the absence of reading glasses, individual time or poor compliance.

On the psychosocial questionnaires, for both the treatment and control groups, there was greater than ten percent of data missing for the PRMQ other total, the carer strain index and baseline measures of the subjective work function. A number of participants in both the experimental and control group did not have a significant other to complete the informant questionnaires or attended appointments alone, with poor compliance in asking others to complete and return the informant questionnaires. Greater than ten percent of data points were missing for both the treatment and control groups on the Problem Solving Inventory (PSI) across all measures and time points. Control subjects were not sent the PSI six weeks after baseline which only allowed comparison between groups at baseline and follow-up periods.

To address the missing data, the missing values were estimated on the basis of the EM (expectation maximisation) algorithm to create a ‘filled in’ data set as it was assumed that data were missing at random. This method of data imputation assumes a distribution for the partially missing data and bases inferences on the likelihood under
that distribution (SPSS, 2007). If a value is missing, estimation is made on the basis of a regression based single imputation with all other variables in the model used as predictors. Based on the covariance matrix at each iteration new regression equations are calculated for each variable which are then used to update the best guess for missing values at the next iteration (Graham, 2009). This two step process continues until the changes from iteration to iteration are so small to be judged trivial.

3.5 Neuropsychological test performance

The performance of the treatment group and control group on neuropsychological measures is listed in Table 6. Comparison of the treatment and control group on neuropsychological tests was compared across the baseline and follow-up with a repeated measures ANOVA of TIME (baseline, follow-up) by GROUP (treatment, control) using the filled in data set as described above. The neuropsychological measures were the RBMT E profile score, Camprompt raw score, WAIS III Digit Symbol scale score, WAIS III Letter Number scale score, Elevator Counting raw score, Telephone search scaled score, Telephone search with counting scaled score, Zoo Map profile score, and Brixton profile score at baseline and follow-up for treatment (n = 59) and control groups (n = 21). A higher score indicates a better performance with the exception of the Telephone search tasks. Table 6 displays the group means across baseline and follow-up periods and the interaction results for all neuropsychological variables.

Both the treatment and control group improved performance from baseline to follow-up on the Camprompt F (1, 78) = 6.69, P = 0.01; WAIS3 Digit Symbol subtest F (1, 78) = 10.33, P <0.01; WAIS3 Letter Number subtest F (1, 78) = 3.94, p= 0.05; and on the Brixton test of spatial anticipation F (1, 78) = 5.14, p= 0.03. Across time, subjects in both the treatment and control groups deteriorated significantly on the Telephone Search test F(1, 78) = 39.6, p<0.01. As can be seen from Table 6, there were no significant group-by-time interactions on any of the neuropsychological variables between the treatment and control group across baseline to follow-up.
### Table 6: Mean performance of treatment and control group on the neuropsychological battery across baseline and follow-up.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Treatment Group (n = 59)</th>
<th>Control Group (n= 21)</th>
<th>Time p value</th>
<th>Group x Time p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline Mean (S.D.)</td>
<td>Follow-up Mean (S.D.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RBMT PS</td>
<td>18.6 (9.4)</td>
<td>17.0 (8.8)</td>
<td>14.4 (6.9)</td>
<td>15.7 (7.2)</td>
</tr>
<tr>
<td>Camprompt</td>
<td>19.0 (8.9)</td>
<td>22.5 (9.9)</td>
<td>17.5 (12.4)</td>
<td>19.6 (12.9)</td>
</tr>
<tr>
<td>WAIS3 DSym SS</td>
<td>6.9 (2.9)</td>
<td>7.4 (3.3)</td>
<td>6.7 (2.7)</td>
<td>7.4 (2.7)</td>
</tr>
<tr>
<td>WAIS3 LettNo SS</td>
<td>7.0 (3.3)</td>
<td>7.5 (3.6)</td>
<td>6.2 (2.5)</td>
<td>7.1 (3.0)</td>
</tr>
<tr>
<td>El Count</td>
<td>6.1 (1.5)</td>
<td>6.1 (1.6)</td>
<td>6.0 (1.4)</td>
<td>6.0 (1.5)</td>
</tr>
<tr>
<td>Tel Search SS</td>
<td>7.4 (3.0)</td>
<td>5.5 (4.3)</td>
<td>7.1 (2.4)</td>
<td>4.4 (3.6)</td>
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<tr>
<td>Tel Search Count SS</td>
<td>7.9 (4.7)</td>
<td>7.6 (4.5)</td>
<td>8.0 (3.8)</td>
<td>7.1 (4.7)</td>
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<tr>
<td>Zoo Map PS</td>
<td>1.7 (1.0)</td>
<td>1.7 (1.1)</td>
<td>1.4 (1.1)</td>
<td>1.5 (1.1)</td>
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<td>Brixton PS</td>
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<td>4.9 (2.4)</td>
<td>3.3 (2.2)</td>
<td>3.9 (2.7)</td>
</tr>
</tbody>
</table>

**Legend:** RBMT = Rivermead Behavioural Memory Test-Extended version, WAIS3 = Wechsler Adult Intelligence Scale Third edition, Digit Sym = Digit Symbol subtest from WAIS3, Lett/No = letter number sequencing subtest from WAIS3, TEA= Test of Everyday Attention, El Count = Elevator Count subtest, Tel Search = Telephone Search, Tel Search + Count = Telephone Search While Counting, BADS = Behavioural Assessment of the Dysexecutive Syndrome, SS = scaled score, PS = profile score.

### 3.6 Psychosocial Outcome:

To evaluate the effects of treatment on psychosocial functioning, a two factor (group, time) repeated measures ANOVA was conducted. As noted above, the analysis was conducted on a ‘filled in’ data set due to missing data. The psychosocial measures were the BDI II, the Rosenberg self-esteem inventory, the total self and other rating from the PRMQ, the CIQ and the Carer Strain Index. An analysis of responses on the brief questionnaire designed for the study was also conducted within the domains of memory function, stress as a result of memory problems, impact on home functioning, social functioning and work functioning across baseline and follow-up periods for both treatment (n = 59) and control groups (n = 21). A higher score indicated a better performance for the Rosenberg, PRMQ, and the CIQ. Lower scores indicated better psychosocial outcome on the subjective measures of memory, stress and the impact of memory on home, social and work functioning in addition to the BDI II and carer
stress index. Table 7 displays the group means across baseline and follow-up periods and the interaction results for all psychosocial variables.

Across time, both the treatment and control groups reported a reduced impact of memory problems in the domains of home functioning $F(1, 78) = 7.57, p = 0.01$; social functioning $F(1, 78) = 4.03, p = 0.05$; and work functioning $F(1, 78) = 4.75, p = 0.03$ as measured by a questionnaire designed for this study. Self-esteem as measured by the Rosenberg Self Esteem scale also improved for both groups across time $F(1, 78) = 4.98, p = 0.03$. As can be seen from Table 7, there were no significant group by time interactions on any of the psychosocial variables.

### Table 7: Mean performance of treatment and control group on psychosocial questionnaires at baseline and follow-up.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Treatment Group (n = 63)</th>
<th>Control Group (n = 24)</th>
<th>Time p value</th>
<th>Group x Time p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline Mean (S.D.)</td>
<td>Follow-up Mean (S.D.)</td>
<td>Baseline Mean (S.D.)</td>
<td>Follow-up Mean (S.D.)</td>
</tr>
<tr>
<td>BDI II</td>
<td>14.8 (10.2)</td>
<td>12.4 (10.1)</td>
<td>20.0 (11.8)</td>
<td>18.3 (12.9)</td>
</tr>
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<td>Rosenberg</td>
<td>19.0 (5.4)</td>
<td>20.4 (4.9)</td>
<td>17.0 (5.2)</td>
<td>18.0 (5.2)</td>
</tr>
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<td>PRMQ self</td>
<td>37.2 (12.7)</td>
<td>37.1 (11.8)</td>
<td>36.1 (12.7)</td>
<td>36.6 (12.6)</td>
</tr>
<tr>
<td>PRMQ other</td>
<td>35.7 (8.9)</td>
<td>40.0 (36.7)</td>
<td>32.7 (13.2)</td>
<td>37.7 (42.0)</td>
</tr>
<tr>
<td>CIQ</td>
<td>16.9 (4.8)</td>
<td>16.8 (4.8)</td>
<td>17.4 (5.0)</td>
<td>17.3 (4.5)</td>
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<td>CSI</td>
<td>7.0 (5.4)</td>
<td>6.5 (8.6)</td>
<td>5.4 (5.0)</td>
<td>6.5 (8.3)</td>
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<tr>
<td>Subjective memory</td>
<td>5.7 (2.0)</td>
<td>5.1 (1.9)</td>
<td>5.4 (1.7)</td>
<td>5.4 (1.9)</td>
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<td>Subjective Stress</td>
<td>6.2 (2.7)</td>
<td>5.4 (2.5)</td>
<td>6.2 (2.3)</td>
<td>5.7 (2.3)</td>
</tr>
<tr>
<td>Home Impact</td>
<td>5.2 (2.4)</td>
<td>4.4 (2.3)</td>
<td>5.1 (2.1)</td>
<td>4.5 (2.5)</td>
</tr>
<tr>
<td>Social Impact</td>
<td>5.3 (2.6)</td>
<td>4.4 (2.4)</td>
<td>5.2 (2.7)</td>
<td>4.6 (2.7)</td>
</tr>
<tr>
<td>Work Impact</td>
<td>7.6 (10.1)</td>
<td>6.1 (9.1)</td>
<td>8.8 (8.0)</td>
<td>7.2 (7.0)</td>
</tr>
</tbody>
</table>

**Legend:** BDI II = Beck Depression Inventory second edition, Rosenberg = Rosenberg self-esteem scale, PRMQ self = Prospective and Retrospective Memory Questionnaire, PRMQ other = PRMQ proxy ratings, CIQ = Community Integration Questionnaire, CSI = Caregiver Strain Index.

A discrepancy between self and other ratings of everyday memory function with the PRMQ has been suggested as a measure of insight (Crawford et al., 2006). To determine whether there had been any change in insight before and after training...
across the treatment and control group, the discrepancy between self and other prospective, retrospective and total score on the PRMQ were examined before and after treatment across the treatment and control group. A Chi square analysis was then conducted to determine if the proportion of subjects with a discrepancy between self and other ratings changed across time and group. There was no significant change in the proportion of subjects with a discrepancy between self and other ratings on the prospective, retrospective or total PRMQ score across time for either the treatment or control groups.

3.7 Outcome on the Problem Solving Inventory:
There were three measures of interest on the Problem Solving Inventory: the number of different memory aids suggested in hypothetical memory scenarios; the number of strategies (other than a memory aid) suggested in these memory scenarios and the number of different types of memory aids and strategies suggested. To evaluate the effects of treatment on the Problem Solving Inventory, a time (baseline, follow-up) by group (treatment, control) repeated measures ANOVA was conducted. Comparison of Problem Solving Inventory measures of number of aids, number of strategies and number of different aids/strategies across baseline and follow-up was conducted with 34 treatment subjects and ten control subjects. Table 8 displays the group means across baseline and follow-up periods and the interaction results for the Problem Solving Inventory.

Table 8: Mean performance of treatment and control group on the Problem Solving Inventory at baseline and follow-up.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Treatment Group</th>
<th>Control Group</th>
<th>Time p value</th>
<th>Group x Time p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 34)</td>
<td>(n = 10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Aids</td>
<td>Baseline Mean (S.D.)</td>
<td>Follow-up Mean (S.D.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11.5 (5.8)</td>
<td>16.6 (6.7)</td>
<td><strong>0.03</strong></td>
<td><strong>0.03</strong></td>
</tr>
<tr>
<td>Number of Strategies</td>
<td>4.3 (3.1)</td>
<td>3.9 (1.8)</td>
<td>0.28</td>
<td>0.65</td>
</tr>
<tr>
<td>Number of different aids/strategies</td>
<td>5.3 (2.2)</td>
<td>7.1 (2.8)</td>
<td><strong>0.03</strong></td>
<td>0.08</td>
</tr>
</tbody>
</table>
Across time, the treatment group suggested the use of a significantly higher number of memory aids on the Problem Solving Inventory compared to control subjects $F(1,40) = 5.41, p = 0.03)$. There was no change in the number of strategies suggested by either the treatment or control group from baseline to follow-up. Whilst both groups described the use of a higher variety of memory aids and strategies at follow-up compared to baseline, there was a near significant trend for this increase in the treatment group $F (1, 40) = 3.14, p = 0.08$. That is, at follow-up treatment subjects were more likely to suggest use of a greater variety of memory aids and/or strategies in hypothetical memory situations.

### 3.8 Discussion

This chapter has presented the outcome of treatment in the Memory Aids Clinic with a comparison between the treatment group and control group on the memory diary, neuropsychological tests, psychosocial questionnaires and the Problem Solving Inventory. The main findings from this comparison are:

- There was a significant interaction between time and group across the time period from baseline to follow-up. Subjects in the treatment group had significantly higher goal attainment as measured by the memory diary from baseline to the follow-up period, indicating a treatment effect that was maintained across time. In comparison, goal attainment in the control group dropped off from the end of training to follow-up.

- Indeed, goal attainment of treatment group subjects was significantly higher than control subjects at follow-up.

- Demographic variables, neuropsychological or psychosocial function did not predict successful goal attainment across the period from baseline to follow-up.

- Outcome as measured by neuropsychological tests did not differ between groups. Both groups improved on measures of prospective memory, speed of cognition, auditory verbal working memory and non verbal problem solving. Both groups deteriorated on a test of visual search.

- Outcome on psychosocial measures did not differ between groups across time. Self-esteem improved for both groups across time. Both the treatment and control group also reported a reduced impact of memory problems in the
domains of home, work and social functioning as measured by a questionnaire designed for this study. There was no change in insight into everyday memory function after treatment.

- At follow-up, the treatment group generated a higher number of memory aids than control groups on the Problem Solving Inventory.

The findings support the effectiveness of systematic training in memory aids to improve everyday memory performance in people with acquired memory problems at least in the long-term. Treatment effects were maintained over time. Training in Memory Aids Clinic facilitated awareness of memory aid use in different scenarios with evidence of generalisation as measured by the Problem Solving Inventory.

Training was conducted across three sessions and adopted Sohlberg & Mateer’s (1989) acquisition, application and adaptation approach to the teach individual’s to use memory aids. Whilst the results add to the body of support for this approach to training memory aids (see also Ho et al., 2011; Schmitter-Edgecombe et al., 1995; Schmitter-Edgecombe et al., 2008; Sloboda & Richard, 2009), the Memory Aids Clinic utilised this framework for a large, heterogeneous neuropsychiatric group of 80 participants. In addition to a systematic approach to training, prominent components of the intervention included collaborative goal setting within the ICF framework, assessment of compliance, and homework to facilitate generalisation between settings and maintenance (Sohlberg & Turkstra, 2010). A unique aspect of the intervention was a clinic setting which allowed participants to actively choose the memory aids they would use (see Wilson & Kapur, 2009).

Analysis was conducted at a group level and then at the individual level using RCI, as analysis at the group level may have obscured variance in the data due to the heterogeneity of the neuropsychiatric subjects, with differences in disease course and rehabilitation goals. Specifically, the group analysis indicated a significantly greater functional goal attainment in the treatment group relative to the control subjects from baseline to follow-up, a pattern which was confirmed with a subgroup analysis. Unexpectedly, the control group also improved goal attainment from baseline to the end of training, diluting the findings at the end of the training period. Improved goal attainment across the initial six weeks in the control group may reflect the boost of
initial input at the baseline session including collaborative goal setting, discussion of
the aims of the clinic and subsequent memory diary review six weeks later (Jeong &
Cranney, 2009). This input may have activated goals and enhanced motivation to
achieve memory goals in addition to establishing a therapeutic relationship within
which to raise confidence in everyday memory performance- both reflected in higher
self-ratings of performance on the memory diary six weeks after baseline. Use of
proxy ratings of goal attainment may have provided more robust and clean measures
of the controls memory performance.

Analysis at the individual level revealed the expected pattern of results as a greater
proportion of treatment group subjects improved from baseline to the end of training.
The treatment group included participants with a non-progressive or a progressive
neurological condition. As the group analysis may have obscured the differential
performance of subjects with a non-progressive condition, further analyses of
subgroups by disease course were conducted as will be presented in Chapter 4.

The main outcome measure was the goal attainment diary which was developed on
the basis of the outcome measure used in the Neuropage evaluations (Wilson et al.,
1997; Wilson et al., 2003). Briefly, at baseline participants were asked to identify
everyday memory goals to target in the Memory Aids Clinic. A diary was created for
the participant to note daily goal attainment and this was completed at baseline, the
end of training and again at follow-up. There are a number of difficulties inherent in
this measure including the reliability of this self-report data and the specificity of
goals. To ensure that the memory diary was completed, significant others were
enlisted to supervise records. Text reminders and phone calls were also made to
prompt diary completion. Even with this support, a significant number of participants
did not complete the diary. An analysis to identify who was more likely to complete
the diary did not indicate any relationship between group (treatment or control),
gender or disease course (progressive or non-progressive). Those who completed the
diary had a better auditory verbal working memory and reported poorer community
integration. Subjects who completed the memory diary reported their memory as
worse than non-completers, which suggested a possible source of increased
motivation and engagement with treatment. Engagement may have been facilitated
by increased education about the purpose of the memory diary as part of a general
introduction to memory rehabilitation program (see Van den Broek, 2005). Reliability of the goal attainment diary may have been facilitated by having significant others take complete responsibility for the diary, as illustrated by Limoncello et al (2011) and McDonald et al (2011).

No relationship was found between demographic, neuropsychological or psychosocial measures and positive outcome in the Memory Aids Clinic, as reflected by maintenance of treatment gains from baseline to follow-up. This lack of relationship is unexpected given previous reports of the influence of variables such as age, number of aids used pre brain injury on successful use of memory aids (Wilson & Watson, 1996; Evans et al., 2003). In addition, previous literature has suggested that people with a less severe memory impairment and without executive dysfunction use memory aids more effectively (Wilson & Watson, 1996; Evans et al., 2003). These previous reports examined the relationships between individual characteristics and general memory aid use as opposed to the impact of such variables of the ability to learn how to use memory aids. Yet, the lack of a relationship between participants’ cognitive profile and treatment outcome is not clinically intuitive. As the heterogeneity of the current sample may have obscured these predictive relationships, sub-group analyses were conducted and are reported in Chapter 4.

Measurement of outcome in neuropsychological rehabilitation has moved from evaluation of change on neuropsychological measures to change in functional abilities and participation. Neuropsychological assessment was included in the current study to guide treatment given previous reports in the literature as described in the previous paragraph. This allowed analysis of the effect of training on neuropsychological functioning. Unfortunately, a significant amount of neuropsychological data was missing. Inspection of data indicated that this was due to poor compliance with testing, level of impairment, motor difficulties, and visual difficulties in the absence of reading glasses. Both groups improved across time on measures of prospective memory, speed of cognition, auditory verbal working memory and non-verbal problem solving and deteriorated on a test of visual search. Alternative forms were used were available. The lack of group by time interaction is not surprising as the intervention was not directed towards improving performance on neuropsychological
tasks and, indeed, standardised assessment precludes use of memory aids to assist test performance.

It was expected that increased everyday memory function would have a positive impact upon general mood, self-esteem, participation and caregiver strain. The lack of group by time interaction on psychosocial measures was unexpected. Adoption of a more psychotherapeutic approach through additional sessions to explore self-efficacy (Cicerone, 2012), personal significance and acceptance (see Gracey et al., 2009) of managing everyday memory problems may reveal an impact on formal measures of mood and self-esteem. The time frame of the intervention may not have been sufficient to capture changes in participation as measured by the CIQ, a measure designed for a traumatic brain injury population (Willer et al. 1993).
4 RESULTS- Comparison of non-progressive and progressive participants

4.1 Introduction
Memory impairment is one of the defining features of dementia, such as Alzheimer’s disease (AD), and of Mild Cognitive Impairment, evidence of greater than expected for age cognitive changes which may or may not progress to dementia (MCI; Petersen 2004). Although the bulk of evidence for the effectiveness of memory aids arises from participants with a non-progressive neurological disorder (traumatic brain injury, stroke, encephalitis etc.), there is growing evidence for the utility of neuropsychological rehabilitation and, more specifically, memory aids for individuals with a progressive neurological disorder such as AD or MCI (Clare, 2008).

Memory aids have been integrated into general memory rehabilitation programs for people with dementia. Clare and colleagues (2010) included training in the use of memory aids within a group program for people with AD and demonstrated increased attainment of everyday goals relative to a waiting list control group. In a similar group treatment program, Kinsella and colleagues (2009) incorporated training in memory aids, education about memory and memory strategies for people with MCI. Results showed improved awareness of memory strategies and improved prospective memory performance. Improved awareness of the use of memory strategies has also been demonstrated in a group program for people with MCI which included training in memory aids and how to maintain everyday functionality (Troyer et al., 2001). Awareness was assessed with presentation of hypothetical memory scenarios which formed the basis of the current study’s Problem Solving Inventory. Training schedules for use of low technology memory aids by people with early dementia or MCI have been investigated, including the Sohlberg and Mateer (1989) model, (Greenaway et al., 2008; Greenaway et al., 2012; Schmitter-Edgecombe et al., 2008). Individuals with progressive neurological conditions have also been trained in the use of more technological memory aids, although studies have focused on aids that require minimal interaction from the user, such as in the Enable project (Duff & Dolphin, 2004) or Smart Home technology (e.g. Evans et al., 2011).
The previous chapter presented the results of the overall comparison between treatment and control subjects in the Memory Aids Clinic. The group analysis indicated that goal attainment was significantly higher in the treatment group relative to the control group from baseline to follow-up. Analysis at the level of individual subjects indicated that more participants in the treatment group improved from the end of training to follow-up relative to those in the control group. To determine if this reflects differences in the effectiveness of treatment for participants with a progressive or non-progressive disease, additional analyses were conducted. In the sub-group of participants with a non-progressive condition, comparison was made between treatment and control groups and in the sub-group of participants with a progressive condition, comparison was made between treatment and control groups. A final comparison was made between participants with a non-progressive or a progressive condition in the treatment group. As with the overall analysis, a number of outcome measures were used to evaluate the effect of training in the Memory Aids Clinic. These were: functional goal attainment as measured by the everyday memory diary; neuropsychological test performance; psychosocial questionnaire responses; and responses on the Problem Solving Inventory.

4.2 Participants
In the non-progressive group, performance of 42 subjects in the treatment group was compared to performance of 13 subjects in the control group. The diagnoses of participants in the non-progressive treatment sub-group were stroke or ‘vascular’ (n=8), seizure disorder (n = 8), traumatic brain injury which ranged from severe to post concessional syndrome (n=4), hypoxic brain injury (n=6) including two with presumed perinatal injuries, Human Immunodeficiency Virus (n=3), brain tumour (n=4), encephalitis (n=3), Systemic Lupus Erythematos (n=2), alcohol-related cerebral dysfunction (n=3), and myalgic encephalopathy (n=1). Similarly in the non-progressive control group diagnoses of participants were stroke or ‘vascular’ (n=4), seizure disorder (n = 3), traumatic brain injury (n=1), hypoxic brain injury (n=1) and alcohol-related cerebral dysfunction (n=4).

In the progressive group, performance of 17 subjects in the treatment group was compared to 8 subjects in the control group. The diagnoses of progressive treatment sub-group were: Mild Cognitive Impairment (n=10), Alzheimer’s dementia (n=3),
vascular such as small vessel disease (n=2), and multiple sclerosis (n=2). Diagnoses of participants in the progressive control sub-group were Mild Cognitive Impairment (n=2), Alzheimer’s dementia (n=3), and vascular such as small vessel disease (n=3).

4.3 Results of Non-progressive Group- Treatment outcome as measured by the memory diary

A two way repeated measures ANOVA was conducted with the factors of time (baseline, end of training, follow-up) and group (treatment, control group) to examine the effect of treatment in the Memory Aids Clinic on everyday memory performance. The mean and standard error of scores of each group across these three time points is shown in Figure 5. There was a significant main effect of time as performance on the memory performance diary changed for both groups, F (2, 58) = 7.19, p <0.00. There was no significant main effect of group F (1, 29) = 2.56, P = 0.12. There was a significant group by time interaction as the treatment group significantly increased everyday memory performance relative to the control group F(2,58) = 3.40, p = 0.04 across time.

To facilitate comparison with performance of the progressive subjects, t-tests were conducted to compare mean goal attainment at baseline, the end of training, and at follow-up. At baseline, there were 39 treatment subjects and 11 control subjects with a non-progressive condition. There was no significant difference between groups at baseline t (48) =1.43, p = 0.16. At the end of training, there were 30 treatment subjects but only six control subjects with a non-progressive condition available for comparison. There was a significant difference between treatment and control subjects at the end of training, with treatment group participants achieving greater scores of everyday memory performance t (34) = 2.59, p = 0.02. At follow-up, there were 32 treatment subjects and nine control subjects with a non-progressive condition available for comparison. There was a significant difference in functional goal attainment between groups t (39) = 2.77, p = 0.01 reflecting a similar pattern to the overall group analysis (see Figure 3, in chapter 3.3.1)
4.3.1 Individual analysis of the memory diary in participants with a non-progressive condition

A Reliable Change Index (RCI) had previously been calculated for each subject with a non-progressive neurological condition as described in Chapter Three. As noted above, the RCI was deemed to reflect a significant improvement if the value was 1.96 or greater, to reflect no change if the RCI was between 1.96 and -1.96 and a deterioration if the values was less than -1.96. The RCI scores were used to classify participants into three groups of improved, same or worse across the three time comparisons of baseline to end of training, baseline to follow-up and end of training to follow-up. A Fisher Exact test was then conducted to investigate whether the proportion of participants who changed across time periods differed between the treatment and control groups within participants with a non-progressive condition.

Numbers were small and data were missing from both the treatment and control groups across all three time period comparisons as not all subjects completed the memory diary. From baseline to the end of training, 40 percent (n = 17/42) of subjects (with a non-progressive condition) in the treatment group improved, 31 percent (n =
13/42) did not change and no subjects recorded deterioration in their performance. Twenty nine percent of data from treatment group subjects was missing (n = 12/42). In the control group, nine percent (n = 1/11) of subjects improved everyday memory performance across the baseline to end of training period, 45.5 percent (n = 5/11) stayed the same and no subjects deteriorated. However, 45.5 percent (n = 5/11) of control subjects had missing data for this time period. There was no significant relationship between group membership and change across baseline to end of training (p= 0.10, Fisher exact test). The lack of significance may reflect the small subject numbers contained in this analysis.

From baseline to follow-up, 43 percent (n =18/42) of subjects with a non-progressive condition in the treatment group improved their everyday memory performance. Thirty one percent (n = 13/42) of treatment subjects did not record a change and two percent (n = 1/42) of subjects’ performance had deteriorated. Data were missing for 24 percent (n = 10/42) of treatment subjects. In comparison, only eight percent (n = 1/13) of control subjects had improved and 54 percent (n = 7/13) of subjects’ performance had remained the same. No control subjects recorded deterioration in everyday memory performance and thirty eight percent (n = 5/13) of data was missing. There was significantly higher goal attainment in the treatment group relative to the control group across baseline to follow-up (p = 0.05, Fisher exact test).

From the end of training to follow-up session, the everyday memory performance of 52 percent (n = 22/42) of treatment subjects with a non-progressive neurological condition remained the same. Seven percent (n = 3/42) of treatment subjects recorded deterioration in performance. A large number of subjects had missing data points across this time period (41 percent, n = 17/42). In the control group, thirty eight percent (n = 5/13) of subjects’ everyday memory performance remained the same, eight percent (n = 1/13) recorded an improvement. No subjects had recorded deterioration in performance and again there were a large number of missing data points (54 percent, n = 7/13). There was no significant relationship between group membership and change from the end of training to follow-up (p = 0.27, Fisher exact test).
4.3.2 Non-progressive group-Prediction of improved everyday memory performance from demographic variables, neuropsychological and psychosocial measures.

It is important to identify the characteristics of subjects who benefit from training in memory aids to allow the clinician to match a memory aid to the person’s needs and thus improve treatment effectiveness and long term use of the memory aid (Sohlberg & Turkstra, 2011). With evidence of a significant treatment effect at the end of training and follow-up for subjects with a non-progressive condition, regression analyses were conducted on the demographic variables of age, years of full time education, and the number of memory aids used at the time of the baseline assessment. Relationships between predictor variables and outcome were only examined within the treatment group. Separate simple linear regression analyses were conducted with outcome defined according to either the RCI analysis as 1 = improved, 2 = same or 3 = worse across the baseline to end of training and from baseline to follow-up.

Age, years of education and number of memory aids used at the time of referral did not predict outcome as defined by the RCI analysis or the difference score between baseline and follow-up or baseline and the end of training. As noted in the whole group analysis, the absence of a predictive relationship is unexpected given previous reports that positive outcome is associated with use of a higher number of memory aids premorbidly, younger age and higher education (Wilson & Watson, 1996; Evans et al., 2003).

The relationship between baseline neuropsychological variables and outcome in subjects with a non-progressive condition was explored with multiple regression analyses using memory, attention/concentration, and executive function as predictors entered in a forced entry method. Memory function grouped performance on the RBMT-E and the Camprompt. Attention and concentration function grouped performance on the TEA Elevator counting subtest, the TEA Telephone Search subtest, the TEA Telephone Search with Counting subtest, the WAIS III Letter Number Sequencing subtest and the WAIS III Digit Symbol subtest as predictors. Executive function reflected performance on the BADS Zoo Map test and the Brixton
Spatial Anticipation test. Outcome was defined in two ways as either change on the memory performance diary according to the RCI analysis as 1 = improved, 2 = same or 3 = worse or according to the difference score of the memory performance diary across two time periods. Prediction of outcome across baseline to the end of treatment and from baseline to the follow-up assessment was examined in the treatment subjects with a non-progressive condition.

Neuropsychological function at baseline within the domains of memory, attention/concentration and executive function did not predict outcome. There were no significant relationships between these predictor variables and outcome defined according to the RCI analysis from baseline to follow-up or baseline to the end of training. There was no significant relationship between neuropsychological, attention/concentration or executive function variables and the difference score of the memory performance diary from baseline to follow-up or baseline to the end of treatment. Again, the absence of a positive relationship is contrary to the literature which has suggested that people with a less severe memory impairment and without executive dysfunction use memory aids more effectively (Wilson & Watson, 1996; Evans et al., 2003).

To explore whether baseline psychosocial function predicted outcome across the baseline to end of training period or from baseline to follow-up, linear regression analyses were conducted using scores on measures of mood (Beck Depression Inventory II), self-esteem (Rosenberg Self Esteem measure), subjective memory reports (Prospective Retrospective Memory Questionnaire), participation (Community Integration Questionnaire) and carer strain (Carer Strain Index). As with the regression analyses described above, outcome was defined according to either the RCI analysis as 1 = improved, 2 = same or 3 = worse or the difference score of the memory performance diary across from baseline to end of training or the difference score from baseline to follow-up.

Psychosocial function at baseline did not predict treatment outcome from baseline to the end of training or from baseline to follow-up regardless of whether outcome was defined in terms of the reliable change index across this period or the difference score on the memory performance diary.
4.3.3 Non-progressive group- Neuropsychological test performance

To compare performance of the treatment and control group (non-progressive subjects only) on neuropsychological tests repeated measures ANOVA of GROUP (treatment, control) across TIME (baseline, follow-up) was conducted. The filled in data set was utilised as described in section 3.3. The neuropsychological measures were the RBMT-E profile score, Camprompt raw score, WAIS III Digit Symbol scale score, WAIS III Letter Number scale score, Elevator Counting raw score, Telephone search scaled score, Telephone search with counting scaled score, Zoo Map profile score, and Brixton profile score at baseline and follow-up for treatment (n = 59) and control groups (n = 21). A higher score indicates a better performance with the exception of the Telephone search tasks. Table 9 displays the group means across baseline and follow-up periods and the interaction results for all neuropsychological variables.

Table 9: Mean performance of treatment and control group on the neuropsychological battery across baseline and follow-up.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Treatment Group (n = 42)</th>
<th>Control Group (n = 13)</th>
<th>Time p value</th>
<th>Group x Time p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline Mean (S.D.)</td>
<td>Follow-up Mean (S.D.)</td>
<td>Baseline Mean (S.D.)</td>
<td>Follow-up Mean (S.D.)</td>
</tr>
<tr>
<td>RBMT E PS</td>
<td>19.7 (8.5)</td>
<td>19.7 (8.1)</td>
<td>15.5 (6.2)</td>
<td>17.8 (6.6)</td>
</tr>
<tr>
<td>Camprompt</td>
<td>20.9 (10.3)</td>
<td>25.8 (9.4)</td>
<td>15.5 (16.3)</td>
<td>20.2 (13.3)</td>
</tr>
<tr>
<td>WAIS3 DSym SS</td>
<td>7.0 (2.7)</td>
<td>7.7 (3.0)</td>
<td>6.5 (1.8)</td>
<td>7.5 (2.1)</td>
</tr>
<tr>
<td>WAIS3 LettNo SS</td>
<td>7.6 (3.5)</td>
<td>7.6 (3.3)</td>
<td>6.4 (2.3)</td>
<td>7.6 (2.9)</td>
</tr>
<tr>
<td>El Count</td>
<td>6.0 (1.6)</td>
<td>6.1 (1.7)</td>
<td>5.7 (1.5)</td>
<td>5.8 (1.7)</td>
</tr>
<tr>
<td>Tel Search SS</td>
<td>7.5 (3.4)</td>
<td>5.7 (4.4)</td>
<td>7.4 (1.8)</td>
<td>4.4 (3.2)</td>
</tr>
<tr>
<td>Tel Search Count SS</td>
<td>8.8 (4.4)</td>
<td>7.7 (4.5)</td>
<td>8.4 (3.7)</td>
<td>6.1 (4.0)</td>
</tr>
<tr>
<td>Zoo Map PS</td>
<td>1.8 (1.0)</td>
<td>2.1 (1.4)</td>
<td>1.6 (0.9)</td>
<td>1.7 (1.3)</td>
</tr>
<tr>
<td>Brixton PS</td>
<td>4.8 (2.4)</td>
<td>5.4 (2.2)</td>
<td>4.1 (2.0)</td>
<td>4.8 (2.0)</td>
</tr>
</tbody>
</table>

Legend: RBMT = Rivermead Behavioural Memory Test-Extended version, WAIS3 = Wechsler Adult Intelligence Scale 3, Digit Sym = Digit Symbol subtest from WAIS3, Lett/No = letter number sequencing subtest from WAIS3, TEA= Test of Everyday Attention, El Count = Elevator Count subtest, Tel Search = Telephone Search, Tel Search + Count = Telephone Search While Counting, BADS = Behavioural Assessment of the Dysexecutive Syndrome, SS = scaled score, PS = profile score.
Both the treatment and control group improved performance from baseline to follow-up on the Camprompt F (1, 53) = 25.50, p<0.01; WAIS3 Digit Symbol subtest F (1, 53) = 9.78, p <0.01; and on the Brixton test of spatial anticipation F (1, 53) = 4.53, p = 0.04. Across time, subjects in both the treatment and control groups deteriorated significantly on the Telephone Search test F (1, 53) = 20.48, p<0.01 and the Telephone Search with Counting subtest from the TEA F (1, 53) = 12.67, p<0.01. As can be seen from Table 9, there were no significant group-by-time interactions on any of the neuropsychological variables between the treatment and control group across baseline to follow-up.

4.3.4 Non-progressive group: Psychosocial performance
To investigate the effect of treatment on the psychosocial function of subjects with a non-progressive neurological disorder, a GROUP (treatment, control) by TIME (baseline, follow-up) repeated measures ANOVA was conducted using the filled in data set. The psychosocial measures were the Beck Depression Inventory II, the Rosenberg self-esteem inventory, the total self and other rating from the Prospective Retrospective Memory, the Community Integration Questionnaire and the Carer Strain Index. An analysis of subjective reports of memory function, subjective stress as a results of memory problems, impact on home functioning, social functioning and work functioning was also conducted across baseline and follow-up periods for both treatment (n = 42) and control groups (n = 13). A higher score indicated a better performance for the Rosenberg, PRMQ, and the CIQ. Lower scores indicated better psychosocial outcome on the subjective measures of memory, stress and the impact of memory on home, social and work functioning in addition to the BDI II and carer strain index. Table 10 displays the group means across baseline and follow-up periods and the interaction results for all psychosocial variables.

Across time, both the treatment and control groups reported a reduced impact of memory problems in the domains of perceived stress F (1, 53) = 5.65, p = 0.02, home functioning F (1, 53) = 4.74, p = 0.03; social functioning F (1, 53) = 4.11, p = 0.05; and work functioning F (1, 53) = 23.15, p <0.01 as measured by a questionnaire designed for this study. Self-esteem as measured by the Rosenberg Self Esteem scale also improved for both groups across time F (1, 53) = 4.24, p= 0.04). Both the
treatment and control group carers reported higher levels of strain on the Carer Strain Index at follow-up $F(1, 53) = 4.12, p = 0.05$. As can be seen from Table 10, there were no significant group by time interactions on any of the psychosocial variables.

Table 10: Mean performance of treatment and control group on psychosocial questionnaires at baseline and follow-up.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Treatment Group (n = 42)</th>
<th>Control Group (n= 13)</th>
<th>Time p value</th>
<th>Group x Time p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline Mean (S.D.)</td>
<td>Follow-up Mean (S.D.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subjective memory</td>
<td>5.7 (1.7)</td>
<td>4.7 (1.7)</td>
<td>6.0 (1.7)</td>
<td>5.7 (2.0)</td>
</tr>
<tr>
<td>Subjective Stress</td>
<td>6.4 (2.5)</td>
<td>5.2 (2.5)</td>
<td>7.2 (2.0)</td>
<td>6.5 (2.0)</td>
</tr>
<tr>
<td>Home Impact</td>
<td>5.2 (2.4)</td>
<td>4.3 (2.4)</td>
<td>5.6 (1.7)</td>
<td>5.1 (2.1)</td>
</tr>
<tr>
<td>Social Impact</td>
<td>5.2 (2.7)</td>
<td>4.4 (2.4)</td>
<td>6.2 (2.2)</td>
<td>5.2 (2.6)</td>
</tr>
<tr>
<td>Work Impact</td>
<td>6.9 (3.1)</td>
<td>4.6 (2.8)</td>
<td>8.3 (3.7)</td>
<td>4.5 (3.4)</td>
</tr>
<tr>
<td>BDI II</td>
<td>16.0 (11.0)</td>
<td>14.3 (10.3)</td>
<td>23.2 (11.2)</td>
<td>20.2 (10.3)</td>
</tr>
<tr>
<td>Rosenberg</td>
<td>18.4 (5.1)</td>
<td>19.7 (5.1)</td>
<td>14.8 (4.9)</td>
<td>16.3 (4.5)</td>
</tr>
<tr>
<td>PRMQ self</td>
<td>35.5 (11.8)</td>
<td>38.1 (12.1)</td>
<td>32.1 (11.8)</td>
<td>33.3 (11.7)</td>
</tr>
<tr>
<td>PRMQ other</td>
<td>36.4 (10.6)</td>
<td>33.8 (21.8)</td>
<td>28.8 (18.6)</td>
<td>30.2 (20.4)</td>
</tr>
<tr>
<td>CIQ</td>
<td>17.2 (4.4)</td>
<td>17.0 (4.6)</td>
<td>16.9 (5.4)</td>
<td>16.8 (5.2)</td>
</tr>
<tr>
<td>CSI</td>
<td>6.2 (5.1)</td>
<td>7.1 (5.8)</td>
<td>8.03 (5.8)</td>
<td>10.4 (8.1)</td>
</tr>
</tbody>
</table>

Legend: BDI II = Beck Depression Inventory second edition, Rosenberg = Rosenberg self-esteem scale, PRMQ self = Prospective and Retrospective Memory Questionnaire, PRMQ other = PRMQ proxy ratings, CIQ = Community Integration Questionnaire, CSI = Caregiver Strain Index.

4.3.5 Non-progressive group- Outcome on the Problem Solving Inventory.

Performance on the Problem Solving Inventory of subjects with a non-progressive condition was explored by comparing treatment subjects with a non-progressive condition with control subjects with a non-progressive condition with the use of independent t-tests from baseline to follow-up. Table 11 shows the responses of subjects with a non-progressive condition on the Problem Solving Inventory. Numbers were small. At baseline, there were 31 subjects in the treatment group and 13 subjects in the control group. At follow-up, there were 32 subjects in the treatment group and only six subjects in the control group.
Table 11: Performance on the Problem Solving Inventory of subjects with a non-progressive condition.

<table>
<thead>
<tr>
<th></th>
<th>Treatment group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline (n = 31)</td>
<td>Follow-up (n = 31)</td>
</tr>
<tr>
<td>Memory Aids</td>
<td>11.20 (6.14)</td>
<td>16.5 (7.04)</td>
</tr>
<tr>
<td>(mean, S.D.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Memory Strategies</td>
<td>4.49 (2.97)</td>
<td>3.78 (1.83)</td>
</tr>
<tr>
<td>(mean, S.D.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Different aids/strategies</td>
<td>5.31 (2.07)</td>
<td>7.47 (2.91)</td>
</tr>
<tr>
<td>(mean, S.D.)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There was no significant difference between the number of memory aids suggested at baseline \([t (42) = -0.80, p = 0.43]\) or at follow-up \([t (36) = 0.85, p= 0.40]\) by subjects with a non-progressive condition in the treatment or in the control group. There was no significant difference in the number of memory strategies suggested at baseline \([t (42) = -0.82, p = 0.42]\) or at follow-up \([t (36) = 0.57, p= 0.57]\). There were also no difference in the number of different memory aids or strategies noted on the Problem Solving Inventory at baseline \([t (43) = -1.03, p =0.31]\) or follow-up \([t (36) = -0.24, p =0.98]\).

4.3.6 Interim Summary

The effect of treatment of subjects with a non-progressive condition in the Memory Aids Clinic was examined by a comparison of treatment subjects with a non-progressive condition with control subjects with a non-progressive condition. The main findings of this analysis are:

- There was a significant group by time interaction between treatment and control subjects across baseline, end of training and follow-up. Treatment subjects had significantly higher goal attainment after training and this was maintained across time. Goal attainment as measured by the memory diary was significantly higher in the treatment group at baseline, the end of training and at follow-up.
- Analysis at the individual level indicated a significant improvement in goal attainment for treatment subjects from baseline to follow-up. Small numbers
were available for analysis which may have contributed to the lack of significant effects across other comparisons.

- Demographic variables, neuropsychological test performance or psychosocial factors did not predict successful outcome in the Memory Aids Clinic for subjects with a non-progressive condition.
- Both groups improved across time on neuropsychological measures of prospective memory, cognitive speed, and nonverbal problem solving. Both groups deteriorated over time on measures of visual search and divided attention.
- At follow-up, both treatment and control subjects with a non-progressive condition reported a reduced impact of their memory problems on stress, home, social and work functioning. There had been an increase in self-esteem across time for both groups.
- There were no differences across time on any measures of the Problem Solving Inventory.

4.4 Results of Progressive group- Treatment outcome as measured by the memory diary

A two way repeated measures ANOVA was conducted with the factors of time (baseline, end of training and follow-up) and group (treatment or control group) to examine the effect of treatment in the Memory Aids Clinic on everyday memory performance for participants with a progressive condition. Numbers were small. There was a significant main effect of time as performance on the memory performance diary changed for both groups, F (2, 22) = 3.982, p = 0.03. There was no significant main effect of group F (1, 11) = 2.24, p = 0.16. There was no significant group by time interaction F(2,22) = 0.60, p = 0.56 across time.

Given the small subject numbers available for comparison, individual t tests were used to compare differences in memory diary performance across baseline, the end of training and at follow-up. Figure 6 shows the mean and standard error of goal attainment for the treatment and control subjects with a progressive neurological condition. At baseline, there were only 14 treatment subjects with a progressive condition and 5 control subjects with a progressive condition. There was no significant difference between treatment and control subjects t (17) = -0.42, p = 0.68.
At the end of training, there were 12 treatment subjects with a progressive condition and six in the control group. There was no significant difference between the treatment and control group \( t (16) = -1.51, p = 0.15 \). At follow-up, there were only 12 treatment subjects with a progressive condition available for comparison with six control subjects. Again, there was no significant difference between the goal attainment of treatment and control subjects with a progressive condition \( t (16) = -0.56, p = 0.59 \).

**Figure 6: Everyday memory performance of participants with a progressive condition across baseline, end of training and follow-up.**

![Graph showing memory performance](image)

4.4.1 Progressive group- Individual analysis of the memory diary

A Reliable Change Index (RCI) had previously been calculated for each subject as described in Chapter Three. The RCI scores were used to classify participants into three groups of improved, same or worse across the three time comparisons of baseline to end of training, baseline to follow-up and end of training to follow-up. As noted above, the RCI was deemed to reflect a significant improvement if the value was 1.96 or greater, to reflect no change if the RCI was between 1.96 and -1.96 and a deterioration if the values was less than -1.96.
Numbers were small and data were missing from both the treatment and control groups across all three time period comparisons. Comparisons were made between 17 subjects with a progressive condition in the treatment group and eight subjects in the control group. From baseline to the end of training, 30 percent of subjects with a progressive condition in the treatment group improved (n = 5/17), 35 percent did not change (n = 6/17) and no subjects recorded deterioration in their performance. Thirty five percent of data was missing (n = 6/17). In the control group, no subjects improved, 25 percent (n = 2/8) stayed the same and no subjects deteriorated. However, 75 percent of control subjects (n = 6/8) had missing data for this time period. For subjects with a progressive neurological condition, there was no significant relationship between group membership and change across baseline to end of training (p = 0.49, Fishers exact test).

From baseline to follow-up, 12 percent of subjects with a progressive condition in the treatment group improved their everyday memory performance (n = 2/17). Forty seven percent (n = 8/17) of treatment subjects did not record a change and twelve percent of subjects’ (n= 2/17) performance had deteriorated. Data was missing for 29 percent of treatment subjects (n = 5/17). In comparison, only 12.5 percent of control subjects (n = 1/8) had improved and 37.5 percent (n = 3/8) of subjects’ performance had remained the same. No control subjects recorded deterioration in everyday memory performance and fifty percent of data was missing (n = 4/8). There was no significant relationship between group membership and change across baseline to end of training (p = 1.0); again small subjects numbers are noted.

From the end of training to follow-up session, no treatment subjects with a progressive neurological condition improved performance on the everyday memory diary. Forty seven percent of treatment subjects (n = 8/17) stayed the same and no subjects recorded deterioration in performance. A large number of subjects had missing data points across this time period (53 percent, n = 9/17). In the control group, no subjects reported an improved performance from the end of training to follow-up. Twenty five percent of subjects’ everyday memory performance remained the same (n= 2/8), and twenty five percent (n = 2/8) recorded a deterioration in performance. Again there was a large proportion of missing data in this group (n=
There was no significant relationship between group membership and change across the period from end of training to follow-up (p = 0.09, Fishers exact test).

### 4.4.2 Progressive group- Neuropsychological test performance

To compare performance of the subjects in the treatment and control group with a progressive condition on neuropsychological tests a repeated measures ANOVA of GROUP (treatment or control) across TIME (baseline or follow-up) was conducted. The filled in data set was utilised as described in section 3.3. The neuropsychological measures were the RBMT E profile score, Camprompt raw score, WAIS III Digit Symbol scale score, WAIS III Letter Number scale score, Elevator Counting raw score, Telephone search scaled score, Telephone search with counting scaled score, Zoo Map profile score, and Brixton profile score at baseline and follow-up for treatment (n = 17) and control groups (n = 8). A higher score indicates a better performance with the exception of the Telephone search tasks. Table 12 displays the group means across baseline and follow-up periods and the interaction results for all neuropsychological variables.

**Table 12: Mean performance of treatment and control subjects with a progressive condition on the neuropsychological battery across baseline and follow-up.**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Treatment Group (n = 17)</th>
<th>Control Group (n= 8)</th>
<th>Time p value</th>
<th>Group x Time p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline Mean (S.D.)</td>
<td>Follow-up Mean (S.D.)</td>
<td>Baseline Mean (S.D.)</td>
<td>Follow-up Mean (S.D.)</td>
</tr>
<tr>
<td>RBMT E PS</td>
<td>15.6 (11.2)</td>
<td>11.9 (9.4)</td>
<td>12.6 (8.0)</td>
<td>12.3 (7.1)</td>
</tr>
<tr>
<td>Camprompt</td>
<td>13.2 (8.6)</td>
<td>15.2 (10.7)</td>
<td>13.9 (9.7)</td>
<td>13.2 (9.0)</td>
</tr>
<tr>
<td>WAIS3 DSym SS</td>
<td>6.2 (3.6)</td>
<td>6.5 (4.0)</td>
<td>7.8 (3.4)</td>
<td>8.4 (3.1)</td>
</tr>
<tr>
<td>WAIS3 LettNo SS</td>
<td>6.7 (3.5)</td>
<td>6.4 (3.6)</td>
<td>6.8 (3.3)</td>
<td>6.6 (3.1)</td>
</tr>
<tr>
<td>El Count</td>
<td>6.3 (1.3)</td>
<td>6.4 (1.2)</td>
<td>6.4 (1.1)</td>
<td>6.5 (0.8)</td>
</tr>
<tr>
<td>Tel Search SS</td>
<td>6.8 (3.0)</td>
<td>4.4 (4.6)</td>
<td>7.9 (4.2)</td>
<td>5.0 (5.4)</td>
</tr>
<tr>
<td>Tel Search Count SS</td>
<td>14.6 (26.3)</td>
<td>7.8 (7.2)</td>
<td>8.7 (12.1)</td>
<td>9.7 (4.7)</td>
</tr>
<tr>
<td>Zoo Map PS</td>
<td>1.2 (1.2)</td>
<td>1.3 (1.4)</td>
<td>1.5 (1.2)</td>
<td>1.3 (0.9)</td>
</tr>
<tr>
<td>Brixton PS</td>
<td>3.7 (2.0)</td>
<td>3.4 (2.8)</td>
<td>2.6 (1.7)</td>
<td>1.9 (4.2)</td>
</tr>
</tbody>
</table>
Performance deteriorated for both the treatment and control group subjects with a progressive condition on the telephone search subtest from baseline to follow-up $F(1, 23) = 25.24$, $p = <0.01$. As can be seen from Table 12, there were no other significant effects of time or group by time interactions on any of the neuropsychological variables.

### 4.4.3 Progressive group-Psychosocial outcome:

To investigate the effect of treatment on the psychosocial function of subjects with a progressive neurological disorder, a GROUP (treatment of control) by TIME (baseline or follow-up) repeated measures ANOVA was conducted using the filled in data set. The psychosocial measures were the Beck Depression Inventory II, the Rosenberg self-esteem inventory, the total self and other rating from the Prospective Retrospective Memory, the Community Integration Questionnaire and the Carer Strain Index. An analysis of subjective reports of memory function, subjective stress as a result of memory problems, impact on home functioning, social functioning and work functioning was also conducted across baseline and follow-up periods for both treatment ($n = 17$) and control groups ($n = 8$). A higher score indicated a better performance for the Rosenberg, PRMQ, and the CIQ. Lower scores indicated better psychosocial outcome on the subjective measures of memory, stress and the impact of memory on home, social and work functioning in addition to the BDI II and carer strain index. Table 13 displays the group means across baseline and follow-up periods and the interaction results for all psychosocial variables.

As can be seen from Table 13, there was no significant effect of time or any significant group by time interactions on any of the psychosocial variables.
Table 13: Mean performance of treatment and control group on psychosocial questionnaires at baseline and follow-up.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Treatment Group</th>
<th>Control Group</th>
<th>Time p value</th>
<th>Group x Time p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n =17 )</td>
<td>(n=8 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Baseline Mean (S.D.)</td>
<td>Follow-up Mean (S.D.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subjective memory</td>
<td>5.8 (2.5)</td>
<td>6.0 (2.2)</td>
<td>0.56</td>
<td>0.91</td>
</tr>
<tr>
<td>Subjective Stress</td>
<td>5.8 (3.1)</td>
<td>5.9 (2.6)</td>
<td>0.96</td>
<td>0.80</td>
</tr>
<tr>
<td>Home Impact</td>
<td>5.2 (2.6)</td>
<td>4.6 (2.2)</td>
<td>0.27</td>
<td>0.91</td>
</tr>
<tr>
<td>Social Impact</td>
<td>5.3 (2.8)</td>
<td>4.5 (2.7)</td>
<td>0.58</td>
<td>0.58</td>
</tr>
<tr>
<td>Work Impact</td>
<td>8.8 (17.0)</td>
<td>21.1 (44.8)</td>
<td>0.08</td>
<td>0.91</td>
</tr>
<tr>
<td>BDI II</td>
<td>12.2 (7.6)</td>
<td>9.5 (8.8)</td>
<td>0.63</td>
<td>0.44</td>
</tr>
<tr>
<td>Rosenberg</td>
<td>20.5 (5.8)</td>
<td>23.9 (7.0)</td>
<td>0.16</td>
<td>0.16</td>
</tr>
<tr>
<td>PRMQ self</td>
<td>35.5 (25.3)</td>
<td>33.3 (27.9)</td>
<td>0.59</td>
<td>0.76</td>
</tr>
<tr>
<td>PRMQ other</td>
<td>74.3 (98.4)</td>
<td>56.5 (74.4)</td>
<td>0.53</td>
<td>0.37</td>
</tr>
<tr>
<td>CIQ</td>
<td>16.2 (5.7)</td>
<td>19.4 (12.8)</td>
<td>0.42</td>
<td>0.45</td>
</tr>
<tr>
<td>CSI</td>
<td>5.3 (27.9)</td>
<td>2.2 (33.5)</td>
<td>0.39</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Legend: BDI II = Beck Depression Inventory second edition, Rosenberg = Rosenberg self-esteem scale, PRMQ self = Prospective and Retrospective Memory Questionnaire, PRMQ other = PRMQ proxy ratings, CIQ = Community Integration Questionnaire, CSI = Caregiver Strain Index.

4.4.4 Progressive group- Outcome on the Problem Solving Inventory.

Independent t-tests were used to explore the performance on the Problem Solving Inventory of subjects with a progressive condition in the treatment group and subjects with a progressive condition in the control group. Numbers were small. At baseline, there were 12 treatment progressive treatment subjects and six controls, at follow-up this had dropped to 11 treatment subjects and five controls.
As seen in Figure 7, there was a significant difference in the number of memory aids reported on the Problem Solving Inventory by progressive subjects in the treatment group compared to subjects with a progressive condition in the control group. There was no significant difference between subjects in the treatment group (mean = 11.4, S.D. 5.3) and the control group (mean = 7.7, S.D. 3.6) t (16) = 1.547, p= 0.14 at baseline. At follow-up, those subjects with a progressive condition (mean = 14.2, S.D. = 4.9) who had received treatment suggested a significantly higher number of memory aids in hypothetical memory scenarios than those in the control group (mean = 9, S.D. 3.5) t (14) = 2.11, p = 0.05.

There was no significant difference between the number of memory strategies suggested by progressive subjects in the treatment or control groups at baseline t (16) = -1.298, p = 0.21 or at follow-up t (14) = 0.62, p 0.55. There was no significant difference between the diversity of memory aids or strategies suggested by subjects with a progressive or non-progressive condition at baseline t (16) = 0.94, p = 0.36] or at follow-up [t (14) = 0.19, p = 0.86].

**Figure 7: Performance on the Problem Solving Inventory by subjects with a progressive condition.**
4.4.5 Interim summary
A comparison was made between subjects with a progressive condition in the treatment group and control group. The results are as follows:

- There was no significant difference in goal attainment at baseline, end of training or at follow-up between treatment subjects and control subjects with a progressive condition. With no difference between groups, this suggests that there was no treatment effect for subjects with a progressive condition.
- On neuropsychological tests, in the progressive group both the treatment and control subjects deteriorated on a test of visual search.
- There was no change over time on psychosocial questionnaires in either the treatment or control subjects with a progressive condition.
- Treatment subjects with a progressive condition reported the use of more memory aids on the Problem Solving Inventory.

4.5 Comparison of treatment group participants with a non-progressive and progressive condition.

4.5.1 Outcome on the Memory Diary
A final comparison was made between subjects in the treatment group with a non-progressive condition and those with progressive condition on everyday memory diary performance. A repeated measures ANOVA with the factors of time (baseline, end of training, follow-up) and group (progressive or non-progressive) was conducted. Numbers were small due to missing memory diary data. There was a significant effect of time as performance on the memory diary changed for both groups $F(2, 41) = 12.78, p < 0.01$. There was no significant group by time interaction $F(2, 41) = 2.16, p = 0.13$. However, performance for the groups across time appeared to be different as noted in Figure 8. Therefore, independent t tests were conducted to examine differences between these groups at baseline, the end of training and follow-up.

At baseline comparison was made between 39 subjects with non-progressive condition and 14 subjects with a progressive condition. There was no significant difference in memory diary performance between subjects $[t (51) = -0.35, p = 0.97]$. At the end of training, comparison was made between 30 subjects with a non-
progressive condition and 12 subjects with progressive condition. There was a significant difference between groups \( t (40) = -2.00, p = 0.05 \) with non-progressive subjects achieving a higher percentage of goal attainment. At follow-up, comparison was made between 32 subjects with a non-progressive condition and 12 subjects with a progressive condition. The difference remained such that subjects with a non-progressive condition attained significant higher goal attainment relative to subjects with a progressive condition \( t (42) = -2.39, p = 0.02 \).

**Figure 8: Everyday memory performance of participants in the treatment group with a non-progressive or progressive condition across baseline, end of training and follow-up.**

4.5.2 **Outcome on neuropsychological tasks.**
Given the significant difference between non-progressive and progressive treatment group subjects on the memory diary, further analyses were conducted to examine any differences in neuropsychological test performance at baseline and across time. To examine differences between non-progressive and progressive treatment group subjects at baseline, independent t tests were conducted. Using the filled in data set described in chapter 3, comparison was made between 42 subjects with a non-
progressive condition and 17 subjects with a progressive condition from the treatment group. The results are shown in Table 14.

Table 14: Comparison of treatment subjects with non-progressive or progressive condition on neuropsychological tasks at baseline.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Non-progressive treatment subjects (n = 42)</th>
<th>Progressive treatment subjects (n=17)</th>
<th>t value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (S.D.)</td>
<td>Mean (S.D.)</td>
<td></td>
</tr>
<tr>
<td>Estimated FSIQ</td>
<td>101.0 (14.0)</td>
<td>105.7 (16.4)</td>
<td>0.22</td>
</tr>
<tr>
<td>RBMT E PS</td>
<td>19.7 (8.5)</td>
<td>15.6 (11.2)</td>
<td>0.13</td>
</tr>
<tr>
<td>Camprompt</td>
<td>21.3 (8.8)</td>
<td>13.2 (8.6)</td>
<td>0.00</td>
</tr>
<tr>
<td>WAIS3 DSym SS</td>
<td>7.1 (2.7)</td>
<td>6.6 (3.5)</td>
<td>0.60</td>
</tr>
<tr>
<td>WAIS3 LettNo SS</td>
<td>7.2 (3.3)</td>
<td>6.6 (3.4)</td>
<td>0.54</td>
</tr>
<tr>
<td>El Count</td>
<td>6.1 (1.6)</td>
<td>6.2 (1.3)</td>
<td>0.67</td>
</tr>
<tr>
<td>Tel Search SS</td>
<td>7.7 (3.1)</td>
<td>6.9 (2.9)</td>
<td>0.41</td>
</tr>
<tr>
<td>Tel Search Count SS</td>
<td>8.2 (4.8)</td>
<td>7.0 (4.2)</td>
<td>0.36</td>
</tr>
<tr>
<td>Zoo Map PS</td>
<td>1.8 (0.9)</td>
<td>1.3 (1.1)</td>
<td>0.06</td>
</tr>
<tr>
<td>Brixton PS</td>
<td>4.8 (2.4)</td>
<td>3.6 (2.2)</td>
<td>0.09</td>
</tr>
</tbody>
</table>

Legend: FSIQ = Full scale IQ, RBMT E= Rivermead Behavioural Memory Test-Extended version, WAIS3 = Wechsler Adult Intelligence Scale Third edition, Digit Sym = Digit Symbol subtest from WAIS3, Lett/No = letter number sequencing subtest from WAIS3, TEA= Test of Everyday Attention, El Count = Elevator Count subtest, Tel Search = Telephone Search, Tel Search + Count = Telephone Search While Counting, BADS = Behavioural Assessment of the Dysexecutive Syndrome, SS = scaled score, PS = profile score.

Significant differences were found between treatment subjects with a non-progressive condition and those with a progressive condition on baseline neuropsychological performance. Treatment subjects with a progressive condition performed worse on the test of prospective memory t (57) = -3.43, p < 0.01. There was a near significant effect for subjects with a progressive condition to have poorer performance on the executive tests of planning: Zoo Map t (57) = -1.93, p = 0.06 and non-verbal concept formation: The Brixton Spatial Anticipation Test t (57) -1.736, p = 0.09. These results suggest that progressive subjects had poorer memory and greater executive dysfunction which may have contributed to their reduced ability to benefit from training in the Memory Aids Clinic.
To further explore factors contributing to the poor performance of treatment subjects with a progressive condition on the memory diary, change in neuropsychological performance across time was examined. A two way repeated measures ANOVA was conducted with the factors of group (non-progressive or progressive) and time (baseline and follow-up). Baseline and follow-up neuropsychological performance, significance values and interaction effects are presented in Table 15. There was a significant effect of time on the RBMT-E $[F(1,57) = 4.11, p = 0.05]$ as both groups decreased performance across time and on the Camprompt $[F(1, 57) = 9.19, p < 0.01]$ as both groups improved performance from baseline to follow-up. Both groups deteriorated across time on the Telephone Search subtest $[F(1,57) = 21.8, p<0.01]$. There was a significant group by time interaction for performance on the Brixton test $[F(1,57) = 5.68, p = 0.02]$. Inspection of means indicated that subjects with a non-progressive condition improved performance on this task in contrast to deterioration in performance for subjects with a progressive condition. This suggests that deterioration in executive function across time may underpin poor outcome as measured by the memory diary in the Memory Aids Clinic for this subgroup.

Table 15: Mean performance of treatment subjects with a non-progressive or progressive condition on the neuropsychological battery across baseline and follow-up.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Non-progressive treatment subjects (n = 42)</th>
<th>Progressive treatment subjects (n= 17)</th>
<th>Time p value</th>
<th>Group x Time p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBMT E PS</td>
<td>Baseline Mean (S.D.) 19.7 (8.5) Follow-up Mean (S.D.) 19.1 (8.5)</td>
<td>Baseline Mean (S.D.) 15.6 (11.2) Follow-up Mean (S.D.) 11.5 (8.7)</td>
<td><strong>0.05</strong></td>
<td>0.13</td>
</tr>
<tr>
<td>Camprompt</td>
<td>21.3 (8.8) 25.3 (7.8)</td>
<td>13.2 (8.6) 15.4 (10.8)</td>
<td>&lt;0.01</td>
<td>0.36</td>
</tr>
<tr>
<td>WAIS3 DSym SS</td>
<td>7.1 (2.7) 7.6 (3.1)</td>
<td>6.6 (3.5) 6.7 (3.9)</td>
<td>0.13</td>
<td>0.32</td>
</tr>
<tr>
<td>WAIS3 LettNo SS</td>
<td>7.2 (3.3) 7.9 (3.5)</td>
<td>6.6 (3.4) 6.4 (3.6)</td>
<td>0.56</td>
<td>0.23</td>
</tr>
<tr>
<td>El Count</td>
<td>6.1 (1.6) 6.1 (1.7)</td>
<td>6.2 (1.3) 6.3 (1.2)</td>
<td>0.77</td>
<td>0.85</td>
</tr>
<tr>
<td>Tel Search SS</td>
<td>7.7 (3.1) 5.9 (4.2)</td>
<td>6.9 (2.9) 4.6 (5.9)</td>
<td>&lt;0.01</td>
<td>0.56</td>
</tr>
<tr>
<td>Tel Search Count SS</td>
<td>8.2 (4.8) 7.6 (3.8)</td>
<td>7.0 (4.2) 7.6 (5.9)</td>
<td>0.97</td>
<td>0.32</td>
</tr>
<tr>
<td>Zoo Map PS</td>
<td>1.8 (0.9) 1.9 (1.1)</td>
<td>1.3 (1.1) 1.1 (1.1)</td>
<td>0.59</td>
<td>0.37</td>
</tr>
<tr>
<td>Brixton PS</td>
<td>4.8 (2.4) 5.5 (2.2)</td>
<td>3.6 (2.2) 3.2 (2.2)</td>
<td>0.37</td>
<td><strong>0.02</strong></td>
</tr>
</tbody>
</table>
4.5.3 Outcome on psychosocial measures.

Given the significant difference between non-progressive and progressive treatment group subjects on the memory diary, further analyses were conducted to examine any differences in psychosocial performance at baseline. Independent t tests were conducted. Comparison was made between 42 subjects with a non-progressive condition and 17 subjects with a progressive condition from the treatment group. The results are shown in Table 16. There was no difference between groups on psychosocial measures at baseline.

Table 16: Mean performance of non-progressive and progressive treatment subjects on psychosocial questionnaires at baseline.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Non-progressive treatment subjects (n = 42)</th>
<th>Progressive treatment subjects (n = 17)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline Mean (S.D.)</td>
<td>Baseline Mean (S.D.)</td>
<td></td>
</tr>
<tr>
<td>Subjective memory</td>
<td>5.7 (1.7)</td>
<td>5.8 (2.5)</td>
<td>0.90</td>
</tr>
<tr>
<td>Subjective Stress</td>
<td>6.4 (2.5)</td>
<td>5.8 (3.1)</td>
<td>0.41</td>
</tr>
<tr>
<td>Home Impact</td>
<td>5.2 (2.4)</td>
<td>5.2 (2.6)</td>
<td>0.89</td>
</tr>
<tr>
<td>Social Impact</td>
<td>5.2 (2.7)</td>
<td>5.3 (2.8)</td>
<td>0.99</td>
</tr>
<tr>
<td>Work Impact</td>
<td>6.9 (3.1)</td>
<td>5.2 (10.2)</td>
<td>0.25</td>
</tr>
<tr>
<td>BD II</td>
<td>16.0 (11.0)</td>
<td>11.9 (7.6)</td>
<td>0.17</td>
</tr>
<tr>
<td>Rosenberg</td>
<td>18.4 (5.1)</td>
<td>20.5 (5.8)</td>
<td>0.18</td>
</tr>
<tr>
<td>PRMQ self</td>
<td>35.5 (11.8)</td>
<td>41.2 (14.0)</td>
<td>0.12</td>
</tr>
<tr>
<td>PRMQ other</td>
<td>36.4 (10.6)</td>
<td>37.2 (9.4)</td>
<td>0.41</td>
</tr>
<tr>
<td>CIQ</td>
<td>17.2 (4.4)</td>
<td>16.2 (5.7)</td>
<td>0.46</td>
</tr>
<tr>
<td>CSI</td>
<td>6.2 (5.1)</td>
<td>6.8 (6.6)</td>
<td>0.84</td>
</tr>
</tbody>
</table>

Legend: BDI II = Beck Depression Inventory second edition, Rosenberg = Rosenberg self-esteem scale, PRMQ self = Prospective and Retrospective Memory
Questionnaire, PRMQ other = PRMQ proxy ratings, CIQ = Community Integration Questionnaire, CSI = Caregiver Strain Index.

4.6 Discussion:
This chapter analysed the performance of subjects on the basis of a non-progressive or progressive disease course, with treatment subjects being compared to their relative control group. A final comparison was made between treatment subjects with a progressive condition and treatment subjects with a non-progressive condition. The main findings of these comparisons are:

- There was a significant group by time interaction for subjects with a non-progressive condition in the treatment group compared to the control group. Subjects with a non-progressive condition increased functional goal attainment following training in the Memory Aids Clinic and this improvement was maintained across time. In contrast, there was no advantage of treatment for subjects with a progressive condition, with no difference in goal attainment between treatment and control subjects across time.

- The positive outcome for subjects with a non-progressive condition was further illustrated by a direct comparison of subjects in the treatment group with a non-progressive or progressive condition. Attainment of everyday memory goals was significantly higher for subjects with a non-progressive condition after treatment and at follow-up. Differences in neuropsychological baseline performance were evident between treatment participants with a non-progressive condition and those with a progressive condition. Progressive subjects’ prospective memory performance was poorer, with non-significant trends for poorer executive function. Progressive subjects’ executive function deteriorated across time.

- Change in performance on neuropsychological tests was not a focus of treatment in the Memory Aids Clinic. Indeed there was no group by time interaction on any neuropsychological tests for both the comparisons of subjects with a non-progressive condition or progressive condition. In the non-progressive group, both treatment and control subjects improved performance on tests of prospective memory, cognitive speed and nonverbal problem solving across time. At follow-up, both the treatment and control group’s
performance on measures of divided attention and visual search had deteriorated. Similarly, performance of all subjects with a progressive condition had deteriorated over time on a measure of visual search.

- Subjects with a non-progressive condition in both the treatment and control groups reported improved self-esteem and less impact of their memory problems on stress, home, social and work functioning at follow-up. There had been no change in psychosocial functioning for subjects with a progressive condition across time.

- There were no significant differences between treatment and control subjects with a non-progressive condition on the Problem Solving Inventory. However, treatment subjects with a progressive condition did record the use of more memory aids at follow-up.

The finding of a significant treatment effect for subjects with a non-progressive condition is consistent with the literature on the effectiveness of memory aids and supports the use of a systematic approach to training memory aids in an outpatient clinic to achieve everyday memory goals. The effectiveness of low technology and high technology memory aids has been demonstrated with participants with non-progressive neurological conditions akin to the current sample, such as the Neuropage studies (Wilson et al., 2003). Individual analysis of non-progressive subjects did not reveal any significant difference between the treatment and control groups. However, small numbers may have lacked sufficient power to detect differences. As with the analysis in Chapter 3, no predictors of positive outcome emerged. Previous studies have suggested that cognitive function- including severity of memory impairment, executive dysfunction, attention skills- will predict successful use of memory aids (Evans et al., 2003; McDonald et al., 2011). Younger age and premorbid use of memory aids have also been suggested as predictors of effective use of memory aids (Evans et al., 2003). Studies that have identified predictors of successful use of memory aids have either surveyed use in the absence of training (Evans et al., 2003) or reported the outcome of a prescribed treatment program (e.g. Stapleton et al., 2007). The flexible, individualised training program offered in the Memory Aids Clinic may have circumvented these barriers to successful memory aid use in people with non-progressive conditions. The lack of treatment effect on neuropsychological
variables is not unexpected as the intervention did not attempt to improve performance on neuropsychological tasks. Regardless, standardised assessment precludes the application of memory aids to support neuropsychological test performance. The absence of a treatment effect on psychosocial measures was surprising. This may reflect the cognitive as opposed to psychotherapeutic focus of the intervention. Changes in participation may not have been apparent over the time period of the intervention.

The direct comparison of training benefit for participants with a non-progressive to participants with a progressive condition is a novel contribution of the current study. Initial inspection of the results suggests that subjects with a progressive condition did not benefit from training in the Memory Aids Clinic. The subgroup analysis of progressive subjects did not indicate any difference between the treatment and control groups- although caution is advised given small numbers. Within the treatment group, subjects with a progressive condition had significantly poorer goal attainment at the end of treatment and at follow-up relative to those with a non-progressive condition. However, at baseline the progressive treatment subjects had poorer prospective memory and weaker executive function. Executive function had deteriorated at follow-up for progressive subjects. These differences in cognitive function may underpin the lack of benefit from the Memory Aids Clinic intervention for participants with a progressive condition.

This finding that subjects with a progressive condition did not benefit from training in the Memory Aids Clinic is in contrast to previous studies of people with early dementia (Clare et al., 2010) or MCI (Kinsella et al., 2009; Clare et al., 2009; Greenaway et al., 2008). The Memory Aids Clinic offered three training sessions, with provision of homework in between sessions, to address an average of three memory goals. The progressive subjects may have required more than three sessions to benefit from specialised training, particularly given poorer prospective memory and executive functioning at baseline. Indeed the three hours of training offered in the Memory Aids Clinic is lower than the average number of treatment hours reported for memory aid rehabilitation studies with non-progressive subjects (van Heugten et al., 2012; Prigatano & Kime, 2003). Additional sessions may have allowed for greater mastery of memory aids and successful goal attainment prior to addressing the next
goal (Clare et al., 2010, Elhardt et al., 2012) and involvement of significant others as co-therapists (Schmitter-Edgecombe et al., 2008; Clare et al., 2010).

Participants with a progressive condition with more vulnerable cognitive function may have also benefitted from training within the context of general memory rehabilitation. A number of successful group interventions for people with AD or MCI have been described that combine training in memory aids with education, relaxation techniques and increasing awareness of everyday memory function (Clare et al., 2010; Kinsella et al., 2009; Troyer et al., 2001). Such programs may be successful due to a holistic approach that sets the use of memory aids within the context of more general strategies for cognitive difficulties and management of everyday problems. Interestingly, the results indicated that progressive treatment group subjects suggested the use of more memory aids on the Problem Solving Inventory at follow-up compared to subjects with a non-progressive condition, similar to the findings of Troyer and colleagues (2001). This finding suggests an improved awareness of memory aids for subjects with a progressive condition within the wider context of everyday functioning. Thus, the current findings for participants with a progressive condition suggest the utility of memory aid use needs to be anchored within a general neuro-rehabilitation program to meet personal everyday goals.
5 Case Series of Participants with a Non-Progressive Condition.

5.1 Introduction:
The use of compensatory memory aids for the rehabilitation of acquired memory disorders has been recommended as a treatment standard (Elhardt et al., 2008). There is now a growing need for information on how to effectively train memory aids within an acquired brain injury population. Sohlberg and Mateer (1989) presented a systematic approach to training memory aids with the three components of skill acquisition, application of the new skill to everyday life and adaptation or generalisation of the new skill of using a memory aid. This model has been described in the training of smart phones (Svoboda & Richards, 2009; Svoboda et al., 2010) and memory notebooks (Kerns & Thompson, 1998; Schmitter-Edgecombe et al., 1995; 2008) to improve everyday memory function in individuals with both non-progressive and progressive neurological conditions. Sohlberg and Turkstra (2011) updated the training model to the PIE approach of Planning, Intervention and Outcome. Essential elements of training prior to the introduction of the memory aid were described in the Planning phase, with the 1989 model encompassed within the Intervention phase. In the final Evaluation phase, efficacy of the intervention with that individual is documented. The use of a systematic approach to training with inclusion of outcome data lends itself to the presentation of the intervention as a single case experimental design or a series of such cases.

One of the challenges of clinical research into effective memory rehabilitation techniques has been the heterogeneity inherent in this population with different aetiologies, cognitive profile and rehabilitation goals. The utility of randomised controlled trials has been questioned with memory rehabilitation research (Kennedy & Turkstra, 2006) and historically the effectiveness of memory aids and examination of training techniques has utilised small case series, single cases or smaller group studies (Van Heugten et al., 2012; Wilson, 1987). Case series or single case studies removes the challenge of the heterogeneity between subjects and provides the unique opportunity to describe in detail rehabilitation techniques, such as how memory aids may be trained and implemented for an individual with acquired brain injury. Methods have been developed to analyse the effect of an intervention on an
individual’s goals (see Crawford & Howell, 1998; Tate et al, 2008) in case series or single case studies. Such methods overcome the difficulty of how to generalise positive outcomes from the performance of one individual or series of individuals to a larger group of memory impaired people.

In the next two chapters, the outcome of treatment group participants will be examined in more detail in a case series analysis. Chapter 5 presents three cases of participants with a non-progressive disorder and Chapter 6 presents three cases with a progressive disorder. The case series aims to provide more detailed information of the actual training methods utilised within the Memory Aids Clinic and to reflect more closely on those factors that may have contributed to treatment outcome.

A number of measures were used to analyse outcome in the case series. Goal attainment on the memory performance diary for each case was visually inspected to compare individual performance with the non progressive group as described in chapter 4. Outcome on the memory performance diary for each individual was compared to group performance of treatment subjects with a progressive condition as described by Crawford and Howell (1998). Change on neuropsychological measures and psychosocial questionnaires was determined by calculating a Reliable Change Index (RCI). As noted previously, the Reliable Change Index is an indicator of the probability that an observed difference between two scores from the same participant on the same test can be attributed to measurement error (Jacobson & Truax, 1991, 1999; Spreen et al., 2006). When there is a low probability that the observed change is due to measurement error, then one can infer that it reflects other factors - in this case a treatment effect. The RCI can then be thought of as a type of z score (Spreen et al., 2006), such that a score falling outside a range of -1.96 to 1.96 would be expected to occur less than 5 percent of the time due to measurement error. Reliability coefficients were available for the following psychosocial measures BDI II, Rosenberg Self Esteem Scale, Community Integration Questionnaire and the Carer Strain Index. T scores were examined to determine change on the Prospective and Retrospective Memory Questionnaire.

Three treatment group cases with a non-progressive disorder are presented in this chapter. These cases were selected to illustrate in detail the training methods
undertaken in the Memory Aids Clinic and highlight issues including matching the memory aid and training to the individual. The first of these cases provides a general description of the training, including detailed protocols for a range of memory aids. The second extends this detailed examination of the training process with the addition of the meta-cognitive strategy of modified goal management training. The final case presents the different functional goal of remembering written material, which includes discussion of the role of acceptance and adjustment in training.

5.2 CASE STUDY LB

5.2.1 Background:
In 2006, LB, a 51 year old lady with a history of systemic lupus erythematosus (SLE) and anti-phospholipid syndrome, presented to her local doctor with complaints of memory problems. She reported difficulty ‘formulating methodical thoughts’ and maintaining her current job. LB was referred to the St Thomas’ Neuropsychiatry and Memory Disorders Clinic where she presented with complaints of work-related difficulties including poor concentration on routine tasks and problems completing sequential tasks. She also reported difficulty paying household bills, remembering appointments and responding to letters. LB stated that she had experienced memory difficulties for the past three years although she was unable to comment on whether these problems were changing over time. LB described her mood as ‘overwhelmed, burdened with all I need to do’ with feelings of being a failure and of isolation. She described initial insomnia, keeping her awake until late and a tendency to ruminate about the many things she had to do. She described a number of financial concerns. LB also stated her ex-husband’s will in Jamaica had been annulled and she had taken the lawyer who executed the will to court; an on-going process which she was very concerned about.

Neuropsychological assessment in the St Thomas’ Neuropsychiatry and Memory Disorders Clinic was conducted by Dr Eli Jaldow. Results of this initial assessment are shown in Appendix 5. There had been no decline in intellectual functioning from estimated premorbid average levels. Overall current intellectual functioning was estimated to have been in the average range. Verbal and performance based skills were also in the average range. Memory for visual material was impaired relative to
good verbal recall and recognition. Naming was weak. Executive functioning was also impaired with poor non-verbal concept formation. Response inhibition and generation were intact. LB was diagnosed with a mild impairment of visual memory likely to be secondary to her anti-phospholipid syndrome and SLE.

LB was diagnosed with SLE in 2004 at the age of 48. During investigations for her SLE, MRI indicated a small lesion in the left parietal lobe. Review MRI in 2006 again showed a small non specific lesion in the white matter of the left parietal lobe. She also had a history of antiphospholipid syndrome, high cholesterol and arthritis. She had been diagnosed with scleroderma at the age of 18 years. LB had been seen at the Maudsley Psychiatric Hospital at the age of 36 years when she had experienced difficulty staying awake during lectures. A formal psychiatric diagnosis was not made and she was assisted by the prescription of the herb, Guarana.

Born in Jamaica, LB had completed 12 years of school to gain her ‘A’ levels. She went on to complete a three year Bachelor of Science in Sociology. LB then worked in the civil service, in sales and as a teacher; the latter for a period of 15 years. After arriving in the UK in 1991, she had trained and worked as a nurse. LB had also undertaken some legal training and had worked in a support role within a legal firm. She had stopped work in 2003 due to her lupus and associated cognitive problems. LB married in Jamaica at the age of 19 but left the relationship in her 30s. She had three sons from the relationship, all of whom lived in the UK. She lived with her youngest son.

5.2.2 Memory Aids Clinic Presentation:
LB was referred to the Memory Aids Clinic from the St Thomas’ Neuropsychiatry and Memory Disorders Clinic. She presented with complaints of everyday memory problems, including trouble remembering appointments and what she had to do. She recounted the episode where she had forgotten to attend a parent teacher meeting for her son. LB stated that she forgot what she had been told and took longer to complete tasks. This difficulty had negatively affected her work performance. She described an episode whilst working at a legal firm where she had taken too long to draft a legal letter and been provided with negative feedback about her job performance. LB also reported that she lost her belongings within her house, such as her mobile phone,
jewellery, purse and bus pass. She reported moments of absentmindedness where she forgot her intentions upon entering a different room.

LB described symptoms of depression and anxiety associated with her memory difficulties. She was concerned about the effect of such difficulties on her relationships with other people and felt that she was at risk of losing valued relationships. She felt that her memory problems were part of her self-esteem. LB was also concerned about one of her sons but declined to discuss this issue further. She described feelings of worthlessness, that she was “going down the drain” and was “no good”. She felt that she was “losing my life as I cannot do the things that I want”. She described feelings of being overwhelmed as she had “too much on my plate” such that things were “slipping”. LB described early morning wakening, with thoughts about what she had to do and appointments for the following day.

LB felt that she used to be an organised person prior to the onset of her current memory difficulties but felt she had the potential to be organised once again. At the time of the referral, LB used seven existing memory aids and strategies. These were a diary, lists of things to do, a calendar noting things to do and appointments, mentally retracing her steps to locate belongings, a mobile phone, and a Dictaphone. She also relied upon her son to remind her. When asked how she would like things to be different following treatment in the Memory Aids Clinic, LB stated that she wanted to remember things so that she did not disappoint people and to remember little things that otherwise wasted her time such as not missing appointments.

5.2.3 Baseline Neuropsychological Assessment:
LB’s scores on baseline neuropsychological tests when assessed in the Memory Aids Clinic are listed in Appendix 5. Memory was impaired. Performance on the Rivermead Behavioural Memory Test-Extended version was poor. Prospective memory was also impaired, with minimal use of available external memory aids. Overall, attention and concentration skills were impaired. Processing speed was slow. Auditory verbal working memory, visual search and sustained attention were impaired. Executive functions were reduced with weak performance on a test of planning.
On the Beck Depression Inventory II, LB indicated a mild degree of depressive symptoms. She reported a significantly greater degree of prospective compared to retrospective memory failures on a memory questionnaire. On an informant version of this scale, LB’s son reported a similar severity of memory difficulties although he did not differentiate between prospective and retrospective difficulties.

5.2.4 Intervention:
LB identified four goals for the MAC. These were

1. to remember to take her mobile phone with her as she left the house;
2. to remember what she had to do each day, such as appointments and household tasks;
3. to be organised with greater daily structure and
4. to remember to turn off the stove.

To meet her goals of remembering daily tasks and increased organisation, LB was provided with and trained in the use of a dry wipe message board. The board was divided into three sections for each day of the week, for urgent tasks and for other things to do. The neuropsychologist initially wrote these divisions on the board but LB personalised the memory aids once at home by replacing the headings in her own hand writing. Information to be written on the message board included appointments, household tasks, phone messages, and events relating to her children. This board had an adhesive backing and was easily positioned in her front room, near the telephone. At the second training session, LB asked for and was given a second message board to place in her room. Use of the messages boards were supplemented with coloured pens, adhesive attachments and Post it notes.

Components and use of the board were initially described to LB following the key points as listed in the training protocol for use of a whiteboard. This protocol is listed in Appendix 4. Once these verbal instructions had been provided, LB was asked the specific questions listed in the training protocol to ensure that she had acquired an understanding of the components and use of the message board. Whilst she was encouraged not to guess if she did not know the correct answer, LB was able to provide correct responses to the training questions, although these responses were not verbatim. The training questions were repeated twice within the initial session that the
message board was introduced, without error, and then again across the subsequent two training sessions, again without error. LB was also provided with written material about how to use a message board (see Appendix 4).

To facilitate regular review of the message board, LB was given a seven day checklist with four nominated times during each day. At each time, she had to look at the board and tick the checklist. She was encouraged to look at the message board more frequently than four times a day and note if she had done so in this diary. LB was compliant with using the message board as she completed the diary without error. LB was also asked to take photographs of both message boards. Placement of the message board in a prominent position within the house was also used to facilitate regular checking of the message board. Weekly review of the message board was incorporated into the training as every Sunday LB would check outstanding activities, clean the board and plan the week ahead.

Generalisation of message board use was facilitated by discussion of hypothetical situations in which she could use the message board. These examples are listed in Appendix 4. For example, LB was asked how she would use the whiteboard to remember the details of a phone message or her next clinic appointment. At subsequent training sessions, LB denied any difficulty with use of the message board. She stated that it helped her to remember what she had to do and that she found it ‘pleasant to use’ and ‘fun’. Interestingly, by the end of her treatment sessions, LB stated that her son had also begun to use the message board to leave her messages and make notes about what he was doing.

To supplement her home based memory system of the message boards, LB’s diary use was reviewed. At the beginning of treatment she used a large page to a day diary which she kept in her front room at home and a smaller pocket diary which she carried with her. To meet her goal of remembering daily tasks and being more organised, LB was provided with and trained in the use of a Filofax. This was to encourage her to be more efficient in using a portable memory system and was presented as a complement to her home based memory aids. Use of the Filofax was supplemented with a pen, to do lists, post it notes, plain and ruled notepaper. LB initially took a medium sized Filofax but replaced this with a smaller one as it was
more convenient to carry. Components and use of the Filofax were initially discussed with LB as listed in the training protocol (see Appendix 4). Training included taking detailed notes, using a to-do list, using the daily diary section, remembering to take the Filofax with her and review of information. Once this verbal information had been provided, she was asked the questions listed in the training protocol to ensure that she had acquired an understanding of the different sections and how to use these sections effectively. As this information was provided in the final training session, questions regarding regular review of the diary were emphasised. LB was to use her daily routine to review the paper based organiser.

To help LB remember to take her mobile phone with her as she left the house, LB was provided with and trained in the use of a ‘Memo Minder’. This is a small portable motion sensitive device on which a reminder of up to 20 seconds can be recorded. A message to prompt LB not to forget her phone was recorded by the neuropsychologist in session, and she was asked to place the device in a suitable, central location within her home. The message then played every time she walked past the Memo Minder. Within the clinic session, LB was also trained in how to record a message along the guidelines noted in the training protocol (see Appendix 4). Training emphasised the location of the Memo Minder, trouble shooting and the settings of the device. Again, following discussion of the memory aid by the Neuropsychologist LB was asked the questions listed in the training protocol, with encouragement not to guess if she did not know the correct answer. LB was able to provide correct responses over both learning trials, although these were not verbatim repetitions. Training of the Memo Minder focussed on prompts for her mobile phone with discussion of alternative messages to prompt other belongings, such as her new Filofax.

With respect to LB’s goal to use her stove safely, she stated that she forgot to turn the stove off in addition to burning food as she forgot to check what she was cooking. She was provided with a kitchen timer and trained to use it according to the training protocol listed in Appendix 4. As this timer had four alarms, use of the alarms for tasks other than cooking were discussed. LB decided to focus on improving her ability to cook safely prior to using the timer for other tasks. Review at the following training session did not reveal any difficulties with the timer, which LB continued to use solely for cooking.
5.2.5 Results:
At baseline, LB achieved her goals with an overall success rate of 55 percent. At the end of the training sessions, overall goal attainment had increased to 92 percent. Treatment gains were maintained at three month follow-up with a goal attainment of 93 percent. Figure 9 demonstrates that LB performed at a similar level to other subjects with a non-progressive condition in the treatment group at both the end of training ($t = -0.93, p = 0.18$) and at follow-up ($t = -0.90, p = 0.19$). More specifically, following treatment LB remembered to take her mobile phone with a 92 percent success rate and she maintained this level of performance at follow-up. Prior to treatment, she reported remembering what she had to do each day and being organised with a 79 percent and 73 percent success rate respectively. Following treatment and at three month follow up LB did not report any difficulties in these functional areas. Finally, at baseline LB had great difficulty remembering to turn off the stove which she achieved with only a 28 percent success rate. Following treatment this had improved to 79 percent and then at follow-up no errors were made.

Figure 9: LB’s goal attainment at baseline, end of training and three month follow-up in comparison to non-progressive subjects in treatment and control groups.
5.2.6 Follow-up Assessment

Improvement was also evident on performance on neuropsychological assessment three months after training had been completed as shown in Appendix 5. Memory had improved as performance on an ecological test of memory function was now in the average range. Interestingly, performance on a test of prospective memory had improved significantly to be in the above average range, possibly reflecting LB’s new skills in applying memory aids to remember tasks. Attention and concentration abilities had improved, as speed of cognition and auditory verbal working memory were now in the above average range. Divided attention was satisfactory. Sustained attention remained weak, although there was an improvement from baseline levels. Executive skills had also improved with moderate average non verbal abstract reasoning. Planning remained weak. LB’s improvements in prospective memory, processing speed and non verbal concept formation follow a similar pattern to the control group as described in chapter 4.

LB’s performance on psychosocial measures at baseline and at follow-up is listed in Table 17. At follow-up, LB described an improvement in her mood. She stated that she now felt more “adventurous, hopeful” and positive. She felt more able and reported that she enjoyed life more. Subjectively, she felt that her memory difficulties now caused her less stress and had less of a negative impact upon her home and social life. Indeed on a self-rating scale, significant changes were evident in the impact of her memory problems on functioning at home, work and social settings, in a similar pattern to the non-progressive treatment and control groups. Subjectively, the amount of stress that LB now associated with her memory problems was reported as minimal. There had been a significant improvement on a self-report mood questionnaire, as she now only reported a minimal degree of depressive symptoms relative to a moderate degree at baseline (Reliable Change Index = 3.71). There had been no significant increase in her self-esteem as measured by the Rosenberg Self Esteem Scale (RCI = 1.56) in contrast to group data. Interestingly, participation had significantly increased (RCI = 4.08) as measured by the CIQ. LB reported less prospective and retrospective memory failures at follow-up. Her informant did not repeat the companion questionnaire at follow-up. LB did not complete the carer strain index as she lived independently.
Table 17: LB’s performance on psychosocial measures in the Memory Aids Clinic at baseline and follow-up.

<table>
<thead>
<tr>
<th>Questionnaires</th>
<th>BASELINE</th>
<th>FOLLOW-UP</th>
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<tr>
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<td>Work</td>
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<td>n.t.</td>
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</table>

Legend: BDI II = Beck Depression Inventory second edition, Rosenberg = Rosenberg self-esteem scale, PRMQ self = Prospective and Retrospective Memory Questionnaire, PRMQ other = PRMQ proxy ratings, CIQ = Community Integration Questionnaire, CSI = Caregiver Strain Index, TS = T score, n.t. = not tested.

LB demonstrated a good understanding of how memory aids functioned as she stated that if she did not use her “gadgets” or memory systems she forgot information and ‘got into trouble’. She acknowledged her dependence on memory aids but felt that this was fine as it allowed her to function. LB demonstrated an increased awareness of memory aids- after treatment and at follow-up she was able to prescribe significantly more memory aids on a Problem Solving Inventory in keeping with the treatment group performance overall (see Table 18). As noted previously, this may reflect generalisation of training to these different situations. She did not suggest a higher number of strategies across time or a greater variety of aids/strategies again in keeping with the overall pattern of performance of the treatment group. Interestingly, there was a suggested dissociation between her use of memory aids and strategies as measured by the PSI. At baseline, LB suggested more memory strategies than aids, a
pattern that was reversed at follow-up, reflecting a shift to the use of external supports trained within the clinic as opposed to internal memory strategies.

**Table 18: LB’s performance on the Problem Solving Inventory in comparison to treatment and control subjects with a non-progressive condition.**

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<th>Control Group</th>
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<td>Follow-up (n = 31)</td>
<td>Baseline (n = 13)</td>
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<td>Memory Aids</td>
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<td>16.5 (7.04)</td>
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<td>(mean, S.D.)</td>
<td>Follow Up</td>
<td>Baseline</td>
<td>Follow-Up</td>
</tr>
<tr>
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<tr>
<td>(mean, S.D.)</td>
<td>11 (2.07)</td>
<td>5.31 (2.07)</td>
<td>Follow-Up</td>
</tr>
</tbody>
</table>

**5.2.7 Discussion:**
The case of LB was selected to illustrate in more detail the training of low technology memory aids and examine the impact upon attainment of memory goals, neuropsychological and psychosocial measures, and generalisation of treatment as measured by the Problem Solving Inventory. As shown in Figure 9, LB’s attainment of everyday memory goals was the same as the overall group performance with an increase from baseline to the end of training, and maintenance of treatment gains over time. As described in chapter three, there were no significant predictors of outcome from the overall group analysis of the non-progressive group analysis. However, on the basis of previous literature, LB’s previous use of memory aids, her level of education and average intellectual functioning suggested her as a good candidate for training in the use of memory aids (Evans et al., 2003; Wilson & Watson, 1996). In addition, although there was evidence of memory difficulties with a poor performance on the Rivermead Behavioural Memory Test Extended, this was not at floor suggesting some sparing of memory function which she may have been able to utilise in her memory rehabilitation program. Poor information processing, including a marked impairment of sustained attention, and executive dysfunction emerged as potential barriers to being able to benefit from rehabilitations (Wilson & Watson, 1996).
LB was provided with and trained in the use of a number of memory aids including a message board, a Filofax notebook, a motion sensitive reminder and a timer. She demonstrated satisfactory learning within sessions and maintenance of learning between training sessions. The use of memory supports was tailored to her environment, with provision of message boards for an at-home memory support system and the use of the notebook for a memory system when she was outside of the house. Interestingly, LB personalised her message boards erasing the Neuropsychologist’s handwriting and adding her own notes. This reflects her active involvement and interest in her treatment which may have also facilitated her positive outcome. Qualitatively, LB did not describe any difficulty with on-going use of her memory aids across sessions and at follow-up, including the motion sensitive reminder. The audio message on this device had the potential to become irritating. Although LB did not describe such irritation, additional training may have focussed on how to internalise the message played by this reminder (see Von Cramon et al., 1994) thus supporting acceptance of the memory aid and further facilitating maintenance of her rehabilitation goals.

LB was compliant with completion of homework and showed good insight into the use of memory aids. She was eloquent in her description of how she used her message board and diary together. At follow-up, LB reported an increased self-confidence including consideration of returning to paid employment. In the absence of any medication, her mood had improved such that at follow-up she did not endorse a significant degree of depressive symptoms as opposed to a mild degree at baseline. Subjectively she reported less memory failures day-to-day and a lower impact of her memory problems on social and home functioning. Participation had improved as at follow-up LB was less reliant upon her son to complete everyday activities, including housework and shopping; she had begun to visit friends more and had enrolled in a part time course. It may be that her success with using memory aids within the Memory Aids Clinic improved self-efficacy and boosted her mood to increase confidence and participation in daily tasks.

Improved performance on formal measures of neuropsychological functioning was not a focus of treatment in the Memory Aids Clinic. However, LB demonstrated a
number of improvements on neuropsychological measures at the follow-up assessment. Improved performance was evident on measures of everyday memory, prospective memory, sustained attention, and cognitive speed. There was a mild improvement in executive function. These changes were in keeping with the pattern of change in neuropsychological performance of the control group. During the course of treatment and follow-up period, there was no recorded change in LB’s lupus nor in her fatigue levels as noted by review in the St Thomas’ Neuropsychiatry and Memory Disorders Clinic. Application of the memory aids provided in the Memory Aids Clinic may have facilitated an improvement in mood which is reflected in improved information processing and executive skills on formal assessment.

In summary, LB illustrates the impact of effective use of compensatory memory aids when presented in a systematic training package on everyday memory function which in turn improves mood, confidence, and social participation. From a health economics perspective, LB’s case demonstrates the utility of a Memory Aids Clinic to support return to work and enable an individual to ‘fund’ their treatment in the long term through employee tax contributions (see Wilson & Evans, 2003).

5.3 CASE STUDY WR:

5.3.1 Background:
WR, a 35-year-old woman, presented to accident and emergency in May 2004 with a generalised seizure. It appears that she endured a period of status epilepticus before she was transferred from her local hospital to intensive care at St Thomas’ Hospital. CT and MRI were normal. WR underwent a lumbar puncture which showed normal constituents with normal protein. PCR for herpes simplex, varicella zoster virus and enteroviruses was negative. An EEG showed a diffuse encephalopathic process of moderate severity with clear bi-temporal dysfunction, more pronounced on the left. In the context of probable viral encephalitis, WR was treated with Acyclovir followed by Valaciclovir, in addition to anti-seizure medication.

Neuropsychological assessment was conducted in late May when WR was an inpatient and in early June 2004, shortly after she had been discharged. This assessment was conducted by Dr Hana Laing. Results are shown in Appendix 5. Her
premorbid level of functioning was estimated to have been in the average range. On a short form of a test of general intellectual abilities, overall performance was estimated to have been in the average range. Performance based and verbal skills were also estimated to have been in the average range which suggests that there had been no change in intellectual abilities relative to premorbid levels. Verbal memory was satisfactory however non verbal recall was impaired. Naming and verbal fluency were in the average range. Executive functioning was weak, with poor response inhibition. Non verbal concept formation was satisfactory.

WR had a previous diagnosis of von Willebrand’s disease, a hereditary coagulation disorder, and depression. She was right handed.

WR had completed ten years of school and gained eight GCSEs. She denied a history of learning difficulties. WR had also completed a one year part time secretarial course. At the time of her admission she was working as a medical secretary, a position she had been unable to return to due to high level cognitive difficulties subsequent to the presumed encephalitis. WR had also worked as a beautician and had trained in aromatherapy and massage. She had divorced in 1998. Following her illness, she had lived for 18 months with her family. At the time of referral she was living independently and enjoyed spending time with friends, her boyfriend and attending art classes.

5.3.2 Memory Aids Clinic Presentation:
WR was seen in the Memory Aids Clinic approximately four years after her diagnosis of viral encephalitis. She presented with complaints of memory difficulties such that she forgot conversations and meetings, both with friends and formal appointments. She stated that she forgot requests and did not follow through on what people had asked of her. She forgot to turn off her cooker. WR reported difficulty learning new information and felt that she could not hold instructions in mind. She felt her thinking was slow and stated that she often became overwhelmed by information, particularly when reading or subject to too much stimulation. WR reported that she sometimes became lost in new locations. She stated that she forgot where she had put things around the house. She also reported retrospective difficulties with poor recall of when events had occurred. WR described an “obsession with checking that things are
locked” which she found embarrassing and inconvenient as she often returned to the house to double check. She also reported leaving her belongings behind in the house.

WR reported that she was more anxious following the encephalitis. She described “bouts” of anxiety associated with a fear of losing control, a feeling of “threat to her world” and diminished confidence in her abilities. To manage these episodes of anxiety, Ms Redmond used various relaxation strategies and directly challenged her thinking by writing down her thoughts. She had received cognitive behaviour therapy for her anxiety since the encephalitis which she had found to be beneficial.

Prior to her illness, WR described herself as an organised person. She used a number of memory aids at the time of referral, including lists of what she had to do and for shopping. She stated that use of these lists gave her a feeling of accomplishment. WR also used a diary, post it notes, a calendar and strategies such as mentally retracing her actions and leaving items in set places. She was enthusiastic about adopting new memory strategies and reminders to make her feel more confident.

5.3.3 Baseline Neuropsychological Assessment:
WR’s performance on neuropsychological tests at baseline in the Memory Aids Clinic is shown in Appendix 5. Premorbid level of intellectual functioning was estimated to have been in the average range. Performance on a short form of the Wechsler Abbreviated Scale of Intelligence estimated that WR was functioning in the average range. This pattern suggested that there had been no change in intellectual abilities following the encephalitis. Memory was in the average range as measured by an ecological test of memory ability. Weaknesses were evident in prospective and verbal memory. However, when memory aids were available, prospective memory was in the above average range. Attention and concentration skills were mildly impaired, with defective divided attention skills. Concentration was satisfactory. Speed of processing and auditory verbal working memory were in the average range. Visual search was in the superior range. Executive functions were mildly impaired with poor planning. Non-verbal concept formation was in the average range.

On a self-report questionnaire, WR noted a moderate degree of depressive symptoms. She recorded an average level of both prospective and retrospective memory
difficulties and there was no significant difference between her subjective memory report and that of an informant. The informant, WR’s mother, noted a mild degree of strain on a carer strain questionnaire.

5.3.4 Intervention:
WR identified four goals to work on in the MAC. These were

1. to remember daily tasks,
2. to use her cooker safely,
3. to not have to go back and check things, and
4. to feel more confident in taking in information.

WR described her difficulty using her cooker safely as she forgot that she was cooking once she left the kitchen in addition to not turning the stove off when she had finished cooking. She was given and trained in the use of a motion sensitive reminder-a “Memo Minder”- to remind her that she was using the stove when she left the kitchen during a cooking task. The device was to be initially located in the kitchen and set up with a recorded message to turn the cooker off when finished. If WR left the kitchen during a cooking task, a message played prompting her to take the Memo Minder with her into the lounge room. Within her small flat, the message then replayed as she moved within the lounge room, prompting her to return to the kitchen and attend to the stove. The Memo Minder was trained according to the protocol listed in Appendix 4. The components and use of the memory aid were initially discussed and then demonstrated by the neuropsychologist. WR was then asked the training questions under error reduction conditions. She was able to provide suitable responses across two learning trials to demonstrate satisfactory understanding of the function and components of the Memo Minder. The neuropsychologist then recorded a message to prompt WR to turn off the stove once she had finished cooking. WR was also provided with written instructions on how to use the Memo Minder, in addition to the manufacturer’s instructions. She was also provided with a basic kitchen timer which she used when boiling water during cooking. Compliance in using these memory aids was assessed by verbal feedback and WR reported no difficulty using the Memo Minder or the kitchen timer.
As noted, WR used a number of memory aids at the time of referral. To address her goal of remembering daily tasks, use of these memory aids was reviewed and supplemented with a dry wipe message board. In this way, a home based memory system (the message board plus notes) and an ‘on the go’ memory system (a Filofax or other paper based diary) were developed. As with LB, the message board was divided into sections for each day of the week, for urgent tasks and for other things to do. WR stated that she would include reminders about paying bills, watering the plants, appointments and when to put the rubbish out. Use of the board was supplemented with coloured pens, post it notes and magnets with which to attach bills and other notes.

Training use of the message board followed the protocol as described with Case LB (see Appendix 4). Following a description of the message board by the neuropsychologist, WR was asked specific questions about the function and components under error reduction conditions. That is, she was encouraged not to guess if she did not know the answer. WR was able to provide satisfactory responses when the message board was first introduced and at subsequent training sessions. Use of the message board at home was encouraged through discussion of hypothetical situations as listed in the training protocol. Written information about how to effectively use the message board was also provided (see Appendix 4). Weekly review of the message board was incorporated into training. Each Sunday morning between 11am and 12pm, WR suggested that she would update information on the message board, transfer information from her diary to the board and generally plan her week. She set an alarm with a note in her mobile phone to prompt this activity.

WR used two diaries at the time of referral to the Memory Aids Clinic- a small diary that she carried with her and a larger diary that remained at home. She admitted that this system was not ‘foolproof’ as she sometimes felt that she was ‘juggling too many diaries’. To consolidate her diary use and complement the message board, she was given one portable Filofax to replace both diaries. Use of the Filofax was supplemented with notepaper, to do lists, post it notes, pens and stickers. WR was able to choose the design of the organiser from the Memory Aids Clinic display library. As with LB, training followed the format outlined in Appendix 4. Following discussion of the components of the organiser, specific questions were asked about
the daily diary, to do list, and reviewing the Filofax under error reduction conditions. Generalisation was facilitated by discussion of hypothetical situations and use of the organiser as a part of her ‘on the go’ memory system.

To facilitate regular review of the message board and diary, WR was trained in a modified version of Goal Management Training (GMT; Levine et al., 2000). The emphasis of this modified GMT was to regularly review available memory aids as a means of monitoring what had to be done throughout the day. The acronym of STOP was used to encourage WR to ‘Stop’ what she was doing, to ‘Think’ about her memory aids, to ‘Organise’ herself and then ‘Plan’ her next activity. This was written on her message board. She was provided with written information about GMT. In collaboration with WR, three times were selected for a review of memory aids- at 10am, 2pm and 6pm. She was given a small push button alarm (as shown in Figure 10) set by the neuropsychologist for these times, which was attached with Velcro to the message board. Written information was provided to support use of this basic alarm (see Appendix 4). Compliance was assessed with a weekly checklist noting when she stopped to review her memory aids and goals, which was completed with minimal errors.

Figure 10: Push button alarm used to support Goal Management Training.

WR aimed to reduce her checking behaviour. She stated that she often forgot whether she had turned off her hair straighteners and locked the windows such that she returned to the house to check. This memory difficulty caused significant anxiety and irritation. To support WR’s memory for these behaviours, she was provided a small
portable voice recorder- an I Memo (see Appendix 4) - which allowed a message of up to two minutes to be recorded. The recorder was located at her front door, next to her keys, which acted as a prompt for regular use. When WR was about to leave the house, she recorded a brief message stating that she had turned off the hair straighteners and locked the windows. Once the message was recorded, she placed the recorder into her handbag. She then replayed this message as required once out of the house. Training was conducted under error reduction conditions. WR did not have any difficulty correctly answering questions about the function or components of the voice recorder across sessions. She was given opportunities to practise making a recording within the training sessions. At the following session, WR provided positive feedback about her use of the voice recorder and stated that she felt less anxiety and irritation. However, as she felt that she could benefit from a general review of cognitive behavioural strategies to manage anxiety and stress, a referral was made for psychotherapy at her local hospital.

WR’s final goal was to feel more confident taking in information. This goal was addressed through education, provision of strategies and anxiety management advice. Education was provided about the basis for her information processing difficulties, including feedback about her assessment results, the impact of fatigue and the potential contribution of anxiety. WR was encouraged to use notes, her Filofax and the voice recorder to capture information. Chunking of information was recommended with repetition and clarification to ensure accuracy of the message. WR was advised to then refer to this information within the permanent store of her memory aids or rehearse the information at regular intervals to facilitate retention in a form of expanded rehearsal. Written information was provided about management of fatigue and previously useful cognitive behavioural strategies for management of anxiety were reviewed. Support was provided to anticipate and prepare for situations when there would be greater demands on her information processing abilities, such as telephone conversations or in lectures.

5.3.5 Results:
Overall, at baseline WR achieved her goals with a 46 percent success rate. Following treatment functional goal attainment had improved to 76 percent, a level of success that was maintained at three month follow-up (73 percent). Performance relative to
the total group of non-progressive treatment and control subjects is shown in Figure 11. WR’s goal attainment across time confirms successful outcome with respect to overall goal attainment as her pattern of performance on the memory diary follows the overall profile of the treatment group at the end of training (t = 0.01, p = 0.50) and at follow-up (t = 0.04, p =0.48). More specifically, prior to treatment, WR was only able to remember daily plans 38 percent of the time. Following treatment this had improved to an 80 percent success rate, which was maintained at follow-up (71 percent). At baseline, WR only remembered to turn off her cooker with a 56 percent success rate. After treatment and at follow-up, she was able to use the cooker without error. Following treatment, WR’s rated that she only had to check 10 percent of the time relative to 46 percent of the time at baseline. At follow-up, her checking behaviour remained reduced relative to baseline levels at 29 percent. There had been only minimal change in WR’s confidence in taking in new information following treatment to 40 percent from 38 percent of the time. However, at follow-up she felt more confident with a rating of 57 percent.

5.3.6 Follow-up Assessment:
There had been minimal change on formal neuropsychological testing as noted in Appendix 5. Memory remained satisfactory with an average performance on an ecological test of memory function and a very good performance on a test of prospective memory. At review, attention and concentration skills were weak with mildly impaired concentration. Divided attention was again impaired. However, speed of processing and visual search were in the high average range, with the suggestion of improved processing speed across time. Auditory verbal working memory was in the average range. Change in attention/concentration skills were in keeping with the overall performance on both the non-progressive treatment and control group as described in chapter 4. Executive skills were satisfactory with good planning and high average non verbal concept formation.

On review assessment, WR reported that she felt more in control of her life. Although there had been no significant change in her mood on a pen and paper questionnaire (RCI= 1.73), at follow-up she reported only a mild degree of depressive symptoms relative to a moderate level at baseline as measured by the BDI II (see Table 19). There had been no objective change on measures of self-esteem or community
integration. There had been no significant change on self-reports of prospective and retrospective memory complaints. On a subjective screen, WR reported that her memory problems continued to be associated with a degree of stress and have an impact on her ability to cope at home and at social settings. Unfortunately at follow-up, the carer strain index was not completed. Scores on psychosocial measures are reported in Table 19.

Figure 11: WR’s goal attainment at baseline, end of training and three month follow-up in comparison to non-progressive subjects in treatment and control groups.

WR felt that the memory aids had provided practical help and the visual prompt of the message board gave her a sense of achievement. In particular, the message board gave her a sense of achievement in everyday tasks. At follow-up her diary use was reviewed as she now kept the Filofax at home and used a small portable diary when she was out of the house. She used the latter for recording more detailed event information and for monitoring her energy levels. The smaller diary gave her an overview of the week, contained information about daily tasks and to do lists. WR had adapted her use of the small push button alarm to transfer information between diaries every morning and a 6pm alarm to review her day and again transfer information between diaries. Following treatment, WR demonstrated an increased awareness of
available memory aids with prescription of a significantly higher number of memory aids and a greater variety of memory aids and strategies on the Problem Solving Inventory (see Table 20). Her pattern of performance on this measure was in keeping with that of the treatment group in general and significantly higher than the response of the control group for both the number of memory aids and different aids/strategies.

Table 19: WR’s performance on psychosocial measures in the Memory Aids Clinic at baseline and follow-up.

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</table>

**Legend:** BDI II = Beck Depression Inventory second edition, Rosenberg = Rosenberg self-esteem scale, PRMQ self = Prospective and Retrospective Memory Questionnaire, PRMQ other = PRMQ proxy ratings, CIQ = Community Integration Questionnaire, CSI = Caregiver Strain Index, TS = T score, n.t. = not tested.

5.3.7 Discussion

The case of WR was selected to illustrate the use of memory aids in conjunction with goal management training with consolidation of existing memory aids and introduction of new supports to meet everyday goals. Acquisition of new skills in using a motion sensitive reminder and a hand held voice recorder was demonstrated. The use of these memory aids was successfully applied to her everyday life to meet goals of remembering daily tasks, reducing checking behaviour and using her cooker safely. The use of the handheld recorder was successfully applied to everyday life to meet WR’s goal of reducing checking behaviour. The recorder may have been
supplemented with the use of a checklist on a dry wipe board, placed close to her front door. The recorder and checklist could then have been used in tandem to ensure that she did not have to go back and check tasks within her home. The case of WR demonstrates the application of similar memory aids to case LB but to different, individual goals and also introduces the use of a goal management strategy to support the effective use of memory aids with the implementation of a strategy to monitor memory aid use.

Table 20: WR’s performance on the Problem Solving Inventory in comparison to treatment and control subjects with a non-progressive condition.

<table>
<thead>
<tr>
<th></th>
<th>WR</th>
<th>Treatment group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Follow-Up</td>
<td>Baseline (n = 31)</td>
</tr>
<tr>
<td>Memory Aids (mean, S.D.)</td>
<td>13</td>
<td>22</td>
<td>11.20 (6.14)</td>
</tr>
<tr>
<td>Memory Strategies (mean, S.D.)</td>
<td>5</td>
<td>4</td>
<td>4.49 (2.97)</td>
</tr>
<tr>
<td>Different aids/strategies (mean, S.D.)</td>
<td>7</td>
<td>11</td>
<td>5.31 (2.07)</td>
</tr>
</tbody>
</table>

As shown in Appendix 5, formal testing indicated that WR had only mild impairments in memory, attention/concentration and executive function. However she presented with a number of everyday problems suggesting that anxiety may have also been a contributing factor to her subjective difficulties, although the sensitivity of the test battery should also be considered in this high functioning woman. At the initial interview, WR described herself as more “anxious” since her encephalitis, with low confidence in her abilities. A self-report questionnaire indicated a moderate degree of symptoms of depression. Her goals of increasing her confidence and decreasing checking behaviours can be formulated in the context of her anxiety such that the behaviour of checking was underpinned by worry that she may forget or not be able to perform due to low self-belief. Following treatment in the Memory Aids Clinic, application of a voice recorder did significantly improve her checking behaviours. Confidence did improve from baseline levels across time but only to a self-rated level of 57% suggesting potential to increase self-confidence further. WR reported less
symptoms of depression following treatment (mild compared to moderate) and, qualitatively, stated that she felt more “in control” of her life. Education about recovery and the interplay between anxiety/worry and memory performance supplemented training in the use of memory aids. It may be that WR would have decreased her levels of anxiety and increased self-confidence further with additional sessions beyond the intensive three sessions available in the Memory Aids Clinic.

5.4 CASE STUDY JG:

5.4.1 Background:
JG, a 72 year old woman, sustained a subarachnoid haemorrhage (SAH) secondary to a left posterior communicating artery aneurysm in April 2005. Recovery was complicated by hydrocephalus which required insertion of a shunt. This was followed by coil embolisation of the aneurysm. CT scan showed some enlargement of the ventricles, greater on the left than the right. JG experienced one generalised seizure but otherwise made a good recovery. She underwent a period of in-patient neurorehabilitation and was referred to the St Thomas’ Neuropsychiatry and Memory Disorders Clinic for further management of everyday memory difficulties.

JG presented to the St Thomas’ Neuropsychiatry and Memory Disorders Clinic with complaints of memory difficulties including mislaying objects within her house, poor memory for names and new people and an inability to read novels as she did not remember the plot. JG was worried about the possibility of a further seizure. She denied symptoms of lowered mood. Initial neuropsychological assessment was conducted in the St Thomas’ Neuropsychiatry and Memory Disorders Clinic by Dr Eli Jaldow. Results are shown in Appendix 5. Premorbid functioning was estimated to have been in the high average range. Performance on tests of intellectual functioning was estimated to have been in the superior range suggesting that there had been no deterioration from premorbid levels. Naming was satisfactory. Memory was impaired. Non verbal recall and recognition were in the impaired range. Verbal recall was in the borderline range. Verbal recognition memory was in the average range. Executive functioning was weak with impaired verbal fluency. Non-verbal concept formation was satisfactory. JG was diagnosed with memory impairment secondary to subarachnoid haemorrhage.
There was no medical history of note. She stated that she took medication to manage seizures and blood pressure.

Born in France, JG completed 12 years of education in French Lycees in the UK. She then studied a three year Bachelor of Arts followed by a one year teaching diploma course. JG then worked for four years as a teacher in England before working for two years as a teacher in Massachusetts, USA. Upon returning to London, she continued to work as a secondary teacher until she retired at the age of 62. JG married her husband when she was 35 and has two children who lived nearby. She described an active social life, including participation in a book club, regular theatre attendance and working as a volunteer at a local art gallery.

5.4.2 Memory Aids Clinic Presentation:
JG was referred to the Memory Aids Clinic from the St Thomas’ Neuropsychiatry and Memory Disorders Clinic following her complaints of everyday memory problems. She stated that her main complaint was an inability to recall the content of books and long articles. She felt that this made it ‘impossible’ to read and retain knowledge. JG reported that it was difficult to recall the plots of plays, films and TV programmes. She said that sometimes she even forgot what she had seen or whether she had seen a program previously. JG described retrograde memory difficulties with poor memory for what had happened in the previous day or earlier in the day. She reported difficulty finding her belongings within the house and remembering where items were normally stored. JG also described an inability to cope with new technology, such as the television remote control and a recently purchased digital photo frame.

JG described a lack of confidence in her memory and found it ‘tiring’ to remember things. She felt that prior to her SAH she had been an organised person with a good memory. At the time of referral to the Memory Aids Clinic, JG used a number of memory aids including lists which she kept in the kitchen, a diary, a calendar, occasional notes, an address book, labels, and her mobile phone. She also relied on others for occasional prompts and tried to leave objects in set places throughout the house. JG was ‘pleased’ to have a number of memory aids at her disposal as they
supported her memory. When asked how she would like things to be different following the MAC intervention, she stated that she wanted her ‘memory back’.

### 5.4.3 Baseline Neuropsychological Assessment:

Due to the recent neuropsychological assessment in the St Thomas’ Neuropsychiatry and Memory Disorders Clinic, baseline assessment in the Memory Aids Clinic focussed upon memory function. JG’s scores on baseline neuropsychological tests are listed in Appendix 5. Memory was impaired as measured by an ecological test of memory function. Particular difficulty was noted on tasks of verbal learning, verbal recall, prospective memory, non verbal recall, non verbal recognition and route memory. In contrast, on a test of prospective memory in which use of memory aids was permissible, performance was in the average range. Attention and concentration abilities were mildly weak as speed of cognition and visual search were in the average range. Auditory verbal working memory and divided attention were in the low average range. Concentration was intact. Executive function was mildly impaired with poor planning. As noted, non verbal concept formation was intact.

A self-report questionnaire indicated a mild degree of depressive symptoms. Self-esteem was low as measured by the Rosenberg Self Esteem scale. There were significant differences in self-reports of everyday memory performance between JG and her husband as she reported more significant prospective memory difficulties and less severe retrospective memory problems. JG’s husband did endorse some items on a carer strain index.

### 5.4.4 Intervention:

JG identified two goals for the MAC. These were

1. to remember what she had read and
2. to find her belongings within the house. She described her problem as including ‘looking but not seeing’ belongings such as reading glasses.

To assist her goal of locating her belongings within the house, those items that were important to locate were identified and current strategies were reviewed. JG stated that she had difficulty locating her keys, money, her glasses and general belongings. She was then trained in the use of a number of memory aids to locate her belongings within the home environment. To locate her keys, JG was given and trained in the use
of a pair of ‘Key Ringers’ following the protocol listed in Appendix 4. As noted in the protocol, this radio activated alarm is made up of two components. One was attached to JG’s keys, the other to her handbag. When she misplaced her keys within the house, JG was to press the alarm on her handbag which would then activate a loud signal from the alarm attached to the keys. JG would then locate the alarm and her keys. After presentation of information by the neuropsychologist, knowledge of the components of the Key Ringer was trained following the questions in the protocol under error reduction conditions. JG was able to provide correct responses to the training questions although these were not verbatim repetitions of the information provided by the Neuropsychologist. Use of the key ringers was practised in sessions under error reduction conditions. She was also provided with written material about how to use the Key Ringers (see Appendix 4), at which point alternative uses for the device was highlighted. Compliance was assessed by self-report and JG reported that she had not lost her keys since using the Key Ringers.

With respect to her other belongings, JG was encouraged to continue to use a chain to carry and easily locate her glasses. She was provided with a brightly coloured ‘Door Organiser’, a soft material pouch that could be put on a door handle to store money and paperwork. She was encouraged to use this in a prominent location as part of a home based memory system. General strategies to locate objects were also discussed. JG was encouraged to have a set place for items and to always return belongings to these specified locations. Homework included organising her home environment and reducing clutter so that she could more easily scan her environment and find what she wanted. Organisation strategies included the use of notes and labels to identify the location of belongings. Anxiety management strategies were discussed within the context of the negative impact of stress on finding objects. In situ anxiety management strategies were suggested including controlled breathing and self-initiated prompts to stop and think. These were practised in session.

To compensate for difficulty remembering written material, JG was trained in the use of an Olympus VN-1100 portable voice recorder. Remembering what she had read was very important for JG as this was a past-time she gained a lot of enjoyment from both as a solitary activity and from participation in a book club with friends. After discussion and demonstration of the features and role of the voice recorder by the
Neuropsychologist, JG was asked specific questions designed to assess her knowledge of the components of the voice recorder (see Appendix 4). She was also asked to demonstrate how to use the recorder. As before, training was conducted under error reduction conditions such that JG was encouraged not to guess and she did not make any errors across two learning trials. She was also provided with written material about the recorder (see Appendix 4) in addition to the manufacturer’s instructions. Knowledge of components and use of the recorder were reviewed at the following session; again without error. Compliance was assessed by self-report. JG stated that she had adapted use of the voice recorder such that she read a chapter, outlined the main points and then recorded essential points of the chapter. She stated that this process gave her more confidence and calmed her down. Although alternative uses for the voice recorder were discussed, JG identified this memory aid as specifically to help her remember what she had read and to this end she had attached it to her book.

As JG was using a number of memory aids but reporting a low level of confidence in her memory abilities, she was trained in the use of an abbreviated form of Goal Management Training (GMT: Levine et al., 2000) to facilitate more effective use of her memory aids. JG was provided with written information about the principles of reviewing her memory aids within a GMT framework. This included introducing the notion of goal neglect - that she might neglect to review her diary or calendar when engrossed in tasks throughout the day. She was encouraged to use the acronym ‘STOP’ to review her memory aids. That is she had to ‘Stop’ what she was doing, to ‘Think’ about her memory aids, to ‘Organise’ herself and note what she had to do and when she had to do it, and ‘Plan’ her next activity. JG was encouraged to make a note of this acronym in a prominent place within her home memory system and to S-T-O-P at least three times a day in the morning, afternoon and early evening according to her daily routine.

5.4.5 Results:
Overall at baseline, JG achieved her goals with a success rate of 40 percent. At the end of the treatment session, this had improved only marginally to 50 percent and at follow-up overall goal attainment was at 46 percent. As can be seen in Figure 12, JG’s functional goal attainment was akin to that of a control subject and at the end of training there was a non-significant trend for performance to be lower than the non-
progressive treatment group \( (t = -1.48, p = 0.07) \). More specifically, after treatment, JG was able to locate her belongings with a 64 percent success rate which reflected an improvement from baseline levels of 36 percent. However, her ability to recall what she had read had deteriorated to a 36 percent success rate relative to 45 percent at baseline. At follow-up goal attainment was not significantly different from the non-progressive treatment group \( (t = -1.12, p = 0.13) \). JG’s memory for what she had read remained below baseline levels at 36 percent. Her ability to locate items within the house was at 57 percent.

5.4.6 Follow-up Assessment:
Performance on neuropsychological tests remained static as shown in Appendix 5. Memory was again poor as measured by a test of ecological memory function. Ongoing difficulty was noted in verbal learning and recall, prospective memory, route memory and non-verbal recognition. Prospective memory, when supported by available memory aids, was again in the average range. The pattern of performance on tests of attention and concentration was also similar. Speed of cognition and visual search were mildly reduced in the average range. Auditory verbal working memory and divided attention were again reduced in the low average range. On this occasion, concentration skills were mildly impaired. Executive skills continued to be mildly impaired with poor planning relative to high average non-verbal concept formation.

Performance on psychosocial measures is documented in Table 21. At follow-up JG reported a significant degree of distress as her husband had recently been diagnosed and commenced treatment for a life-threatening illness. This may underpin her report of a moderate degree of depressive symptoms relative to mild symptoms at baseline. This change in reported depressive symptoms was not statistically significant \( (RCI = 1.237) \). She otherwise stated that she had found talking to someone ‘outside the family’ about her memory problems beneficial and that she felt happier within herself. There was no significant change in her level of self-esteem after treatment. Subjectively, at follow-up JG reported that her memory problems were not as bad, that they caused her less stress and that the memory difficulties had less of an impact on her ability to cope at home and in social settings. Her responses on this questionnaire were in keeping with the overall non-progressive treatment and control groups. JG endorsed the same level of prospective and retrospective memory
problems. An informants’ report was not available at follow-up. There was no change in her level of community participation as measured by the CIQ, possibly reflecting her high level of activity at baseline.

**Figure 12: JG’s overall goal attainment at baseline, end of training and three month follow-up.**

In contrast to poor functional goal attainment immediately after treatment and at follow-up, JG reported an increased confidence in reading with the use of the voice recorder and stated that she was able to actively part in her book club with the use of this memory aid. She felt able to cope with the use of her memory aids and stated that the voice recorder was useful to summarise written text and ‘focus’ her mind on the immediate points. On-going use of strategies and memory aids to locate belongings was questionable as she stated that locations ‘came back with time’ suggesting the use of possibly inefficient mental search strategies in addition to memory aids. On the Problem Solving Inventory, JG suggested a higher number of memory aids relative to controls at baseline and follow-up. However, there was minimal change in the number of aids suggested before or after treatment (see Table 22). There was no difference between her performance and the control group in the number of strategies suggested on the PSI or the number of different memory aids or strategies suggested.
Table 21: JG’s performance on psychosocial measures in the Memory Aids Clinic at baseline and follow-up

<table>
<thead>
<tr>
<th>Questionnaires</th>
<th>BASELINE raw</th>
<th>BASELINE scaled</th>
<th>FOLLOW-UP raw</th>
<th>FOLLOW-UP Scaled</th>
</tr>
</thead>
<tbody>
<tr>
<td>BDI-II</td>
<td>15</td>
<td></td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Rosenberg</td>
<td>11/30</td>
<td></td>
<td>15/30</td>
<td></td>
</tr>
<tr>
<td>PRMQ- self pro</td>
<td>25 TS = 42</td>
<td></td>
<td>26 TS = 40</td>
<td></td>
</tr>
<tr>
<td>PRMQ- self retro</td>
<td>28 TS = 35</td>
<td></td>
<td>27 TS = 37</td>
<td></td>
</tr>
<tr>
<td>PRMQ- self total</td>
<td>53 TS = 36</td>
<td></td>
<td>53 TS = 36</td>
<td></td>
</tr>
<tr>
<td>PRMQ- other pro</td>
<td>20 TS = 47</td>
<td>n.t.</td>
<td>n.t.</td>
<td>TS = n.t.</td>
</tr>
<tr>
<td>PRMQ- other retro</td>
<td>31 TS = 26</td>
<td>n.t.</td>
<td>n.t.</td>
<td>TS = n.t.</td>
</tr>
<tr>
<td>PRMQ- other total</td>
<td>51 TS = 35</td>
<td>n.t.</td>
<td>n.t.</td>
<td>TS = n.t.</td>
</tr>
<tr>
<td>CIQ</td>
<td>17/29</td>
<td></td>
<td>17/29</td>
<td></td>
</tr>
<tr>
<td>CSI</td>
<td>4/16</td>
<td></td>
<td>n.t.</td>
<td></td>
</tr>
</tbody>
</table>

Subjective
Memory      | 8            | 4               |
Stress       | 9            | 4               |
Home         | 8            | 4               |
Social       | 5            | 2               |
Work         | n.t.         | n.t.            |

Legend: BDI II = Beck Depression Inventory second edition, Rosenberg = Rosenberg self-esteem scale, PRMQ self = Prospective and Retrospective Memory Questionnaire, PRMQ other = PRMQ proxy ratings, CIQ = Community Integration Questionnaire, CSI = Caregiver Strain Index, TS = T score, n.t. = not tested.

5.4.7 Discussion:
The case of JG was selected for presentation in this chapter to illustrate treatment of different goals (e.g. remembering printed material) and as an example of a participant who did not appear to benefit from rehabilitation within the Memory Aids Clinic as measured by her attainment of everyday memory goals. Figure 11 indicates that her performance was more akin to the control subjects with a non-progressive condition than those in the treatment group. The case of JG highlights the issue of how to match available memory aids and technology to an individual’s goals with positive outcome for only one of her chosen goals. JG was able to use a memory aid, in addition to memory strategies, to improve her ability to find her keys and belongings within the house. This is reflected in improvement in goal attainment after treatment which was maintained at follow-up. Interestingly, JG also continued to use mental search strategies at follow-up. It is possible that positive outcome is also underpinned by ongoing use of this internal strategy.
Table 22: JG’s performance on the Problem Solving Inventory in comparison to treatment and control subjects with a non-progressive condition.

<table>
<thead>
<tr>
<th></th>
<th>JG</th>
<th>Treatment group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Follow Up</td>
<td>Baseline (n = 31)</td>
</tr>
<tr>
<td>Memory Aids (mean, S.D.)</td>
<td>15</td>
<td>18</td>
<td>11.20 (6.14)</td>
</tr>
<tr>
<td>Memory Strategies (mean, S.D.)</td>
<td>3</td>
<td>3</td>
<td>4.49 (2.97)</td>
</tr>
<tr>
<td>Different aids/strategies (mean, S.D.)</td>
<td>6</td>
<td>8</td>
<td>5.31 (2.07)</td>
</tr>
</tbody>
</table>

In contrast, JG did not report success in being able to remember what she had read. She was taught how to use a voice recorder to make notes and store details about what she had read, with the aim of supporting her reading so that she could continue to take part in a book club. Qualitatively, JG stated that she was able to use this device to remember what she had read, to take part in the book club and to continue to enjoy reading. This was not reflected in the memory diary records. Making notes on a voice recorder is a different experience from the pleasure of reading and remembering a story and the difference in the experience may be reflected in the diary record. That is, JG did not feel that she was able to remember what she had read as it was such a different experience. An appropriate memory aid to support memory for what has been read has yet to be developed.

With her anxiety about her memory performance, JG’s outcome may have been improved through an exploration of her acceptance of using memory aids and strategies and her adjustment to her memory difficulties. In this way, using a voice recorder to achieve the goal of remembering what she had read may have been incorporated into her self-image. Further sessions could have focused on her anxiety and the meaning she attached to her memory failure. Of note, qualitatively JG did report improvement in her confidence and her ability to remember what she had read at follow-up, even with the added stress of her husband becoming unwell. It may be that the measures used, including the memory performance diary, were not sensitive enough to detect these changes in her self-esteem and everyday function.
5.5 General Discussion:
Three cases have been presented to illustrate in more detail the training procedures conducted within the Memory Aids Clinic for individuals with non-progressive neurological conditions. In these cases the following memory aids were used to attain everyday memory goals: a dry wipe memory board, a paper based diary (in the MAC a Filofax was used), a motion sensitive device, Key Ringers and a portable voice recorder. Training was based on Sohlberg and Mateer’s (1989) model of skill acquisition, application and adaptation. Prior to training, a task analysis of each memory aid was conducted to identify the steps required to use each device (see Sohlberg & Turkstra, 2011). A specialised training protocol was then developed that incorporated elements of error reduction learning (see Wilson, 2009) to ensure accurate acquisition of how to use the memory aid. Application of the new skill was facilitated by the use of homework assignments and compliance measures (see Appendix 4). Adaptation- how to generalise the new skill to different environments, memory challenges or daily tasks- was facilitated by discussion of hypothetical scenarios and education about memory aid use.

Functional goal attainment improved for LB and WR following training in the Memory Aids Clinic, with functional gains maintained across time. Evaluation of message board use to manage memory difficulties has not often been described in the acquired brain injury literature. LB and WR also successfully used personal paper based organisers to remember prospective everyday memory goals. The successful training of such low technology memory aids (notebooks) has previously been described for individuals with traumatic brain injury (Sohlberg & Mateer, 1989; Kerns & Thompson, 1998; Zenicus, 1991). Training in the Memory Aids Clinic was limited to three sessions in which to meet a number of memory goals with the use of a variety of memory aids. Maintenance and generalisation of skills were addressed with discussion of hypothetical memory scenarios within sessions, the systematic approach to training, homework exercises and the assessment of compliance (see Appendix 4). Inclusion of an additional session to increase awareness of the impact of memory problems on everyday life and to anticipate when the memory aids may be used may have further strengthened the outcome for LB and WR as has been suggested in previous studies of notebook use (Schmitter-Edgecombe et al., 1995; Fleming et al.,...
Acceptance of using memory aids could also be addressed as needed with an additional session to explore adjustment to the limitations imposed by cognitive changes following acquired brain injury (Gracey et al., 2009).

Goal attainment improved marginally for only one of JG’s goals (to find her belongings) but she did not report improvement in her ability to remember what she had read. This presents as a challenge for the management of everyday problems within a Memory Aids Clinic. Some everyday memory problems may be more suitable to the use of compensatory supports than others. Previous attempts to rehabilitate memory for what has been read have adopted the internal strategy of PQRST- Preview Question Read State and Test (see Wilson, 2009; Miotto et al, 2007). This elaborative method aims to support memory through increasing elaboration of encoding of material. However, it is laborious, effortful and may be more suitable as a study method as opposed to reading for pleasure. Written notes and post it notes may be of some use to compensate and provide prompt to aid recall (Wilson & Kapur, 2009). Prescription of a voice recorder aimed to compensate for loss of information by providing an alternate form of storage. Qualitatively, JG reported that this did support her memory and that she was able to participate in her book club as a result. However, her acceptance and use of the voice recorder to support her ability to read may have been facilitated with additional sessions of acceptance of memory aids to explore goal attainment by remembering in a qualitatively different way to before the SAH. This highlights the need to address acceptance and an understanding of the role of memory aids as a foundation for successful outcome.

The third case, JG, was presented to illustrate limited improvement as measured by the goal attainment diary. She reported on-going participation in her book club whilst the memory diary records suggested that she was unable to remember what she had read. Failure to capture meaningful improvement in JG’s everyday performance may reflect problems associated with the memory diary. JG may have recorded her performance incorrectly according to whether she could remember without recourse to the memory aid. Reliability of responses from the memory diary could have been improved with performance recorded by a significant other (Limoncello et al., 2011)
or use of a semi-structured questionnaire to measure functional goal attainment (see Hurn et al., 2006). The memory performance diary was developed for the present study on the basis of the records used the evaluate Neuropage (Wilson et al., 2003).

The Memory Aids Clinic was developed in a holistic framework, mindful of the importance of an individual’s emotional and cognitive needs in the context of their social/personal environments (see Wilson, 2009). The cognitive training focus of the intervention was supplemented with education about brain injury, rehabilitation, the compensatory nature of memory aids and support for mood or anxiety related concerns. Both LB and WR endorsed significantly lower levels of depressive symptoms following treatment. There were qualitative reports of improved self-esteem and hope (LB), and feeling more “in control” of life. The inclusion of additional sessions within the Memory Aids Clinic may have further improved outcome in terms of psychosocial functioning. For example, at follow-up, WR recorded a confidence level of 57% which indicates potential to further increase her subjective rating of self-efficacy. In the case of WR, additional sessions could have included specific behavioural experiments (see McGrath & King, 2004) to explore her confidence with specific reference to the use of memory aids in specific contexts. With the time constraint of three sessions, this may have only been addressed in a superficial manner. Subjective changes in self-esteem were not captured by the formal measures. It may be that the Rosenberg Self Esteem Scale was not sensitive to change in this mixed neuropsychiatric outpatient population. Self-esteem may have not been the best construct to explore in this population. Self-efficacy may be a more potent factor in determining an individual’s confidence to manage changes following brain injury (Cicerone et al., 2008). There was no formal change in participation across these cases nor in the larger treatment group. The Community Integration Questionnaire may not have been sensitive enough to detect changes across the 18 week period of the Memory Aids Clinic. There was qualitative evidence for improved or at least maintained participation as JG continued to take part in her book club, LB was able to consider returning to work and WR to study following treatment in the Memory Aids Clinic.

In addition to systematic training in the use of memory aids, the role of the Memory Aids Clinic was to match the memory aid to the individual’s goals, preferences and
capabilities. All subjects were able to view and select their memory aids- with guidance by the treating neuropsychologist, within the Memory Aids Clinic resource centre hopefully facilitating ownership and active involvement in their rehabilitation (Phillips & Zhao, 1993; Gitlin et al., 1996). Of note, the memory aids available did serve different functions. For example, a voice recorder was used to support memory for what had been read or to reduce checking. Environment was considered with the development of home-based and portable memory systems for both LB and WR. Cognitive profiles were considered, with the introduction of Goal Management Training (Levine et al., 2000) to support executive impairments in WR and JG. Interestingly, two of these three participants with a non progressive condition lived alone and did not have a partner or carer to act as a co-therapist and support their rehabilitation.

Training in the Memory Aids Clinic generalised to hypothetical memory scenarios as listed in the Problem Solving Inventory. All three of the cases presented suggested a higher number of memory aids in hypothetical scenarios at follow-up relative to baseline. This finding reflects the overall result in the treatment group. Successful application of the memory aid to the home environment from the clinical setting reflects another form of generalisation. WR also described generalisation of training in one application of a memory aid to another function. At follow-up she stated that she used her small push button alarm as a reminder to transfer information between diaries every morning and a 6pm alarm to review her day and again transfer information between diaries. This reflects a flexible adaptation of a new skill to a non trained aspect of her everyday memory goals.

The current case series illustrates the specific training techniques used to support three individuals with non-progressive acquired brain injury to meet everyday memory goals. The intervention was successful for two of the three cases presented. Whilst the third case did not formally improve on measures of everyday memory performance, there was qualitative evidence of maintained participation in everyday activities.
6 Case series of participants with a progressive condition.

6.1 Introduction

Conceptualisation of dementia in terms of a bio-psychosocial model has helped to reframe progressive neurological conditions in terms of disability and allow consideration of interventions to improve everyday function. Whilst interventions at the biological level may be limited to medication to slow the progression of conditions such as Alzheimer dementia, support can be provided at a psychological and social level (Clare, 2008). Psychological interventions, including both cognitive and psychotherapeutic support, have the aim of improving functional ability within the social domain. The application of neuropsychological rehabilitation techniques is beginning to be explored in people with Mild Cognitive Impairment (MCI) and Alzheimer dementia (AD). One approach is cognitive training which involves guided practice on a set of tasks designed to reflect particular cognitive functions. Evidence for the effectiveness of cognitive training on improving performance on neuropsychological tests or generalising to everyday function is limited (Clare & Woods, 2003). Rehabilitation, including the use of memory aids, appears to hold more promise to improve or maintain the everyday functioning of people with progressive neurological conditions.

Memory aids have been used within group neuropsychological rehabilitation programs for people with dementia and in studies evaluating the effectiveness of specific memory aids. An eight week program comprised of training in memory aids and strategies was effective in supporting people with early AD to attain everyday functional goals (Clare et al., 2010). Utilising a group format for participants with MCI, Kinsella and colleagues (2009) improved performance on prospective memory tasks and awareness of memory strategies with a rehabilitation program that included the use of memory aids and education about memory strategies. Similarly, a group program with a focus on increasing awareness of memory behaviours to improve everyday functionality, including use of memory aids, increased awareness of available memory strategies in a group of subjects with MCI (Troyer et al., 2001). Systematic training of memory aids has been adopted to support everyday use of
notebooks for people with MCI (Greenaway et al., 2008; 2012) and early AD (Schmitter-Edgecome et al., 1995; Quittre et al., 2005). Interestingly, the use of memory aids in people with progressive conditions has focussed on low technology devices. High technology devices have been utilised for people with more advanced dementia as a form of environmental support, with reduced training requirements. Smart homes, for example, with environmental controls and automatic messages, have been shown to support independent living for people with moderate dementia (Evans et al., 2011). The Enable project examined the effectiveness of stand-alone memory aids that required minimal training, including an automatic day/night calendar, an item locator, an automatic night lamp, a gas cooker device that switched off the appliance if pans overheated, and a picture button telephone (Duff & Dolphin, 2007). Devices were well received by people with dementia and their carers, although limited utility was described by carers of people with more severe cognitive impairment.

The deteriorating nature and the constellation of cognitive impairments in people with progressive neurological conditions need to be considered in the selection and training of memory aids. With inevitable changes in cognitive and everyday function, rehabilitation goals may need to be reviewed on a more regular basis and ‘booster’ sessions may be useful to support maintenance of new skills. As noted previously, the increased age, severity of memory impairment and presence of cognitive impairments in addition to memory problems argue against people with dementia as good candidates for effective memory aid use (see Wilson & Watson, 1996; Evans et al., 2003). To address these challenges to neuropsychological rehabilitation in people with dementia, appropriate learning methods are recommended using error reduction techniques given the severity of explicit memory impairment (Middleton & Schwartz, 2012). Training may need to be conducted at a slower pace with additional carer support (Schmitter-Edgecombe et al., 2008; Clare et al., 2010) to facilitate application of new skills between sessions.

The subgroup analysis presented in Chapter 4 indicated that subjects with a progressive condition did not benefit from training in the Memory Aids Clinic, as measured by goal attainment on the memory diary. This chapter describes three participants with a progressive neuropsychiatric condition from the treatment group to
illustrate in more detail the training techniques used in the Memory Aids Clinic, and examine issues relevant to training including use of carer support, insight and selection of memory aids within this group. Three cases are presented. The first case illustrates in detail the training of memory aids with a man with a diagnosis of Alzheimer’s Disease. The second case describes memory aids training with a woman with a diagnosis of Alzheimer’s Disease who lived alone and for whom a follow-up session was available two years after her initial referral. The final case presents a man with a vascular based dementia who had a goal of remembering past events.

As with Chapter 5, outcome is described in terms of performance on the memory diary, neuropsychological tests, psychosocial questionnaires and the Problem Solving Inventory. Outcome on the memory performance diary for each individual was compared to group performance of treatment subjects with a progressive condition as described by Crawford and Howell (1998). Change on neuropsychological measures and psychosocial questionnaires were determined by calculating a Reliable Change Index (RCI). Reliability coefficients to calculate the RCI were available for the following psychosocial measures: BDI II, Rosenberg Self Esteem Scale, Community Integration Questionnaire and the Carer Strain Index. T scores were examined to determine change on the Prospective and Retrospective Memory Questionnaire.

6.2 CASE STUDY: CC

6.2.1 Background

CC, a 70 year old left-handed man, presented to the Neuropsychiatry and St Thomas’ Neuropsychiatry and Memory Disorders Clinic with a three-year history of progressive memory difficulties. He reported difficulty remembering names and recognising familiar faces. He had forgotten his familiar Masonic rituals and phrases and described difficulty completing DIY tasks around the house. CC had been diagnosed with Alzheimer’s disease by his GP. MRI showed generalised cerebral and cerebellar atrophy, more pronounced on the right but no small vessel disease or large infarcts. Carotid and vertebral artery scans indicated 40 percent stenosis of the right internal carotid artery and 15 percent of the left internal carotid artery. His score on the Mini Mental State Examination was 22/30. Neuropsychological assessment
conducted by Dr Eli Jaldow and his team in the St Thomas’ Neuropsychiatry and Memory Disorders Clinic and results are shown in Appendix 6. Premorbid level of function was estimated to have been in the high average range. There was deterioration in performance-based intellectual skills to the low average range. Verbal intellectual skills remained in the high average range. Memory was variable, with poor immediate verbal recall and non-verbal recognition memory but satisfactory non-verbal recall and verbal recognition memory. Naming was satisfactory. In the St Thomas’ Neuropsychiatry and Memory Disorders Clinic, CC was diagnosed with probable dementia of either the Alzheimer’s type or ‘mixed’ parenchymal and ischaemic aetiology.

Seven months prior to his presentation to the memory clinic, CC sustained a right hemisphere transient ischaemic attack associated with sensory motor disturbance of the left arm. He had a history of high cholesterol and depression.

CC had completed 12 years of schooling. He then completed on-the-job training to qualify as a chartered accountant. He had retired from this profession four years prior to his referral. CC and his wife had been married for 46 years. They had two sons, one of whom had died at the age of 30 in a motor vehicle accident eleven years previously. CC stated that he was an active Freemason and enjoyed his time playing badminton, fishing and gardening.

6.2.2 Memory Aids Clinic Presentation
CC was referred to the Memory Aids Clinic from the Neuropsychiatry and St Thomas’ Neuropsychiatry and Memory Disorders Clinic. He presented with complaints of everyday memory problems, including poor memory for past events, such as what had happened the day before, and for future events, such as dates of appointments and times of trains. He stated that he forgot dates of birthdays, his year of birth and the age of his son. CC reported that he forgot his Freemason rituals and now found it hard to learn new passages for rituals. He admitted to misplacing his belongings, such as his glasses, notes and papers. He felt that his mental arithmetic skills had deteriorated, which was particularly significant given his work as an accountant. CC stated that he did not have ‘a peg to hang things on’ or a ‘picture in his mind’. He reported poor memory for people's names, particularly for people he
had only recently met. He denied difficulty with finding his way when driving. CC’s wife concurred that he had experienced progressive memory problems over a period of three years. She also noted that he asked repetitive questions, for which he had variable awareness. She described some loss of semantic knowledge as he did not know the names of the planets or the colours of the rainbow, and that he occasionally forgot the names of nieces, nephews and garden plants. CC’s wife stated that he left jobs around the house half-finished and he no longer completed crosswords or Sudoku. She attributed the latter to poor concentration. She also noted that he left lights on; put belongings away in the wrong place and had sometimes not turned the gas cooker off.

CC felt that he was a reasonably organised person prior to the onset of his memory difficulties. At the time of referral to the MAC, he used seven memory aids and strategies including a diary, notes, a calendar, mentally retracing his steps or activities, leaving belongings in set places, a day/date watch and colour coded folders for his paperwork. CC did not express any objections to the use of memory aids as he recognised a need to improve his memory.

In view of the recent neuropsychological assessment conducted in the St Thomas’ Neuropsychiatry and Memory Disorders Clinic, baseline assessment in the MAC focussed upon memory function. Results are shown in Appendix 6. Memory was impaired. Overall, performance on an ecological memory task (RBMT-E) was in the impaired range. Specifically, impairments were evident in verbal learning and recall, non-verbal recognition, prospective memory and route memory. Prospective memory was in the borderline range. Attention was impaired, with visual search, divided attention and speed of cognition in the borderline range. Auditory-verbal working memory was in the impaired range. In contrast, concentration skills were intact. Executive function was impaired, with poor planning and non-verbal concept formation.

On a self-report questionnaire, CC did not indicate any significant symptoms of depression. CC reported a degree of prospective and retrospective memory difficulties which fell in the average range and his self-report of memory function did not differ
significantly from the report of his wife. CC’s wife endorsed 10 of 16 items on a carer burden scale.

6.2.3 Intervention
CC identified three goals to achieve within the MAC. These were

1. To remember what he had to do each day
2. To remember the details of appointments
3. To remember what he had been told

Baseline measures were taken with the use of the memory diary to record his success in these tasks each day. He was asked to complete the diary with the assistance of his wife.

To meet his goals of remembering daily events and the details of appointments, CC was provided with and trained in the use of a magnetic dry wipe message board. As described previously in section 5.2.4, the board was divided into days of the week, urgent tasks and other things to do. CC decided that he would use the board to remind him about what he had to do each day, phone calls to make and appointments. The message board was to be located in his study. Use of the board was supplemented with coloured pens, tape to demarcate sections, magnets and Post-it notes. CC was also provided with written information about the board.

Training began with a focus on CC’s acquisition of knowledge about the components of the message board and how use of the message board could be applied in his everyday life. Training was conducted with the use of the protocol listed in Appendix 4. The components and use of the board were first described to CC and his wife who attended the training sessions with him. Use of CC’s board was demonstrated. He was then asked the training questions listed in the protocol under conditions of errorless learning. That is, CC was encouraged not to guess if he did not know the correct answer. He was able to provide the correct responses to the training questions, although these responses were not verbatim. The training questions were repeated in the following training session and CC again provided answers without error. Adaptation of the message board use was facilitated by discussion of hypothetical
situations in which the message board could be used. These examples are listed in the training protocol in Appendix 4.

To ensure regular review of the message board, CC was given a seven day diary with three nominated times. At each time, he had to refer to the message board and tick the corresponding box in the diary. CC also referred to the message board at additional times and noted this in his weekly diary. The weekly diary record indicated that CC was compliant with using the message board. He did not describe any particular difficulty using the message board at subsequent training sessions.

To build upon his premorbid use of a diary to meet his goals of remembering daily events and the details of appointments, CC’s diary use was reviewed. Training was conducted with the use of the protocol listed in Appendix 4 and initially focussed on the role of a daily diary section, locating the diary, making effective notes and reviewing the organiser. Following a discussion of the key components and the use of the diary in his everyday life, the training questions listed in the protocol were asked under error reduction conditions. CC was able to provide correct responses to these questions. The diary was to be kept on his desk or dresser which he felt was an automatic, ingrained habit. To take effective notes, CC was encouraged to note WHO, WHEN, WHAT and WHERE. These key points were written at the front of his organiser.

To ensure regular review of the diary, CC was provided with and trained in the use of a portable push button alarm. Written information was also provided to support use of this alarm (see Appendix 4). The neuropsychologist set the alarm for 1030am and 630pm, times nominated by CC to review his diary. The technique of spaced retrieval was used to train the association between the alarm and diary review, as shown in the training protocol for the whiteboard in Appendix 4. Using this learning technique, CC was able to learn to look at his diary when the alarm rang, with no errors across a three minute delay period. His wife was present during the training session to support correct use of the checklist and alarm between sessions. CC was provided with a seven day diary to record his compliance with reviewing his diary when the alarm sounded. This record indicated compliance with a review of his diary twice a day.
The final goal was to remember what he had been told, CC refused the offer of a small voice recorder to capture the key points from conversations. Thus, effort was directed at his existing memory aids and methods of capturing spoken information. Internal memory strategies of chunking information and repeating messages to clarify information were discussed and practised in therapy sessions. CC was encouraged to use his diary, message board and take notes as a record of spoken information for later recall.

6.2.4 Results
As shown in Figure 13, overall at baseline, CC achieved his goals with an overall success rate of 60 percent. Following training, this had increased to 73 percent, in keeping with the treatment subjects with a progressive condition (t = 0.45, p = 0.33). However, although at follow-up overall goal attainment had returned to pre-treatment levels of 58 percent success rate, this was in keeping with the group performance (t = 0.19, p = 0.43). More specifically, at the end of treatment, CC’s ability to remember details of appointments had improved from a baseline level of 40 percent to 100%. At follow-up this had deteriorated to 63 percent. At the end of treatment, CC had maintained his ability to recall what he had to do each day at approximately the same high baseline level (89 percent). This had deteriorated to 60 percent success at follow-up. CC’s goal of remembering what he had been told in fact declined from 50 to 38 percent following treatment. At follow-up he achieved this goal 50 percent of the time, a return to pre-treatment levels.

6.2.5 Follow-up Assessment
There had been minimal change on neuropsychological tests at the follow-up assessment (see Appendix 6). Memory was again impaired as measured by an ecological test of memory function (RBMT-E). Persistent impairment was evident on verbal learning and recall, route recall and prospective memory. However, there had been a mild improvement on a test of prospective memory which may reflect increased awareness of available memory aids on this task. Attention and concentration skill were again impaired. Visual search was slow. Divided attention, auditory verbal working memory and speed of cognition were in the borderline range.
At follow-up, concentration skills were weak. Executive function remained impaired with low scores on tasks of planning and non-verbal abstract reasoning.

**Figure 13: CC’s overall goal attainment at baseline, end of training and three month follow-up.**

At follow-up, CC reported that his memory had been ‘up and down’. He had recently forgotten a Freemason meeting for the first time as he had been ‘caught up’ in washing the car. He felt that he generally remembered household tasks but admitted to difficulty remembering changes to his routine. CC stated that he continued to attempt DIY tasks which now took longer to complete. As shown in Table 22, although a self-report questionnaire did not indicate any significant change in depressive symptomatology, CC stated that he did not feel well, or ‘alive’. Whilst he slept well, he reported fatigue and a variable appetite. His wife felt that he lost confidence and reported that tasks now took him longer to complete. Subjectively, CC felt that his memory difficulties caused him less stress relative to pre-treatment levels although there had been no change in the impact of memory problems nor functioning at home or in social settings. At follow-up, there was a significant discrepancy between CC’s subjective report and his wife’s report of prospective and retrospective memory problems, as his wife felt that he had a poorer memory overall as measured by a
prospective/retrospective memory questionnaire. Her report of carer burden had not
changed relative to baseline levels and she continued to endorse 10 from 16 items.
Interestingly, following treatment, CC’s level of community integration had
significantly increased (RCI = 2.04) as measured by the Community Integration
Questionnaire.

Table 22: CC’s performance on psychosocial questionnaires in the
Memory Aids Clinic at baseline and follow-up.

<table>
<thead>
<tr>
<th>Questionnaires</th>
<th>BASELINE</th>
<th>FOLLOW-UP</th>
</tr>
</thead>
<tbody>
<tr>
<td>BDI-II</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Rosenberg</td>
<td>19/30</td>
<td>22/30</td>
</tr>
<tr>
<td>PRMQ- self pro</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>PRMQ- self retro</td>
<td>24</td>
<td>23</td>
</tr>
<tr>
<td>PRMQ- self total</td>
<td>47</td>
<td>46</td>
</tr>
<tr>
<td>PRMQ- other pro</td>
<td>25</td>
<td>27</td>
</tr>
<tr>
<td>PRMQ- other retro</td>
<td>23</td>
<td>27</td>
</tr>
<tr>
<td>PRMQ- other total</td>
<td>48</td>
<td>54</td>
</tr>
<tr>
<td>CIQ</td>
<td>12/30</td>
<td>16/30</td>
</tr>
<tr>
<td>CSI</td>
<td>10/16</td>
<td>10/16</td>
</tr>
<tr>
<td>Subjective</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Memory</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Stress</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Home</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Social</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Work</td>
<td>n.t.</td>
<td>n.t.</td>
</tr>
</tbody>
</table>

Legend: BDI II = Beck Depression Inventory second edition, Rosenberg = Rosenberg
self-esteem scale, PRMQ self = Prospective and Retrospective Memory
Questionnaire, PRMQ other = PRMQ proxy ratings, CIQ = Community Integration
Questionnaire, CSI = Caregiver Strain Index, TS = T score, n.t. = not tested.

CC described on-going use of the memory aids provided during the treatment
sessions. He stated that he continued to use his diary, which he reviewed often, and
the message board, which he supplemented with Post it notes. He admitted that he still
forgot to look at his diary on occasion or take it with him. He continued to use the
push button alarm to review the message board. CC also stated that he now used the
push button alarm to help him remember to take his medication, suggesting that his
use of this memory aid had generalised to another, somewhat unrelated, memory task.
There was minimal evidence of generalisation on the Problem Solving Inventory, as
shown in Table 23. CC completed the PSI at baseline and the end of treatment but not
at follow-up. Although he was able to describe a variety of different memory aids and
strategies, his suggested use of different memory aids or memory aids in different situations did not alter from baseline to post-treatment across indices of number of aids, number of strategies or the variety of aids/strategies suggested for the hypothetical scenarios.

Table 23: CC’s performance on the Problem Solving Inventory in comparison to treatment and control subjects with a progressive condition.

<table>
<thead>
<tr>
<th></th>
<th>CC</th>
<th>Treatment group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>End of treatment</td>
<td>Baseline (n = 12)</td>
</tr>
<tr>
<td>Memory Aids (mean, S.D.)</td>
<td>12</td>
<td>13</td>
<td>11.4 (5.3)</td>
</tr>
<tr>
<td>Memory Strategies (mean, S.D.)</td>
<td>2</td>
<td>3</td>
<td>2.7 (1.6)</td>
</tr>
<tr>
<td>Different aids/strategies (mean, S.D.)</td>
<td>9</td>
<td>10</td>
<td>5.3 (2.6)</td>
</tr>
</tbody>
</table>

6.2.6Discussion
The predominant pattern of CC’s performance on the memory performance diary was one of failure to maintain initial gains across time. His goal attainment followed the overall pattern of performance of treatment subjects with a progressive condition. This suggests a greater need for on-going neuropsychological input and support to maintain treatment gains. CC was able to learn to use a message board to remember his appointments and daily tasks, and to use his diary more effectively. His everyday memory for appointments and for daily tasks was, respectively, improved and maintained at the end of training. However, new learning was fragile as these gains were not maintained across time. This may reflect his poor general memory abilities and more generalised cognitive impairment. Neuropsychological assessment indicated poor performance on both the RBMT-E and the Camprompt at baseline, with suggestion of deterioration on the RBMT-E over time. CC also required more intensive training in the form of expanded rehearsal to associate the use of the alarm with the diary. Thus, it may be that the training in the Memory Aids Clinic was not sufficiently intense to consolidate his new skills. Additional sessions may have been
of use through top up and monitoring sessions as opposed to only a review at three months.

Previous learning may also have had a role in CC’s acquisition and application of new skills to compensate for everyday memory problems. He had previously used a diary and a calendar, so it can be assumed that the use of a message board was not too dissimilar for him. CC was hesitant to use a voice recorder to remember what he had been told, which may reflect unfamiliarity with this device. Subjectively it is also a very different way of capturing spoken conversation and instructions and so may require greater adjustment in addition to greater new learning. CC’s difficulty in recalling what he had been told may reflect a combination of poor auditory-verbal working memory and a subsequent impairment in the retention of spoken information. The voice recorder was suggested as a means to capture all of the written information and to store it until the note could be transferred to a more permanent store (his diary) or acted upon. With refusal of this support, internal strategies of chunking the information and using his diary were practised. Additional, more difficult strategies could have been implemented with additional sessions, including specific working memory retraining (Cicerone, 2002).

CC’s wife acted as a co-therapist in his rehabilitation program. It has been suggested that clients with closely involved support networks have more successful use of memory aids, (LoPresti et al., 2004; Wessels et al., 2003). At follow-up, there was a significant discrepancy between CC’s reported subjective memory difficulties and his wife’s report on the PRMQ (Crawford et al., 2006). Reduced insight has been associated with poorer rehabilitation outcome in brain injury rehabilitation (Prigatano, 2005). Poor awareness of memory problems may have undermined CCs use of trained memory aids across time. As this may reflect the combination of both biological and psychosocial changes (Clare, 2008), additional input may have explored his adjustment to his diagnosis and variations in his awareness across time. Given more severe cognitive and memory impairments and reduced insight, participants with a progressive condition may also have a greater need for a supportive family member to act as co-therapist to ensure application of new skills between sessions in the home environment. This issue will be explored further in the following case which describes a woman with AD, living without the support of family or a carer.
6.3 CASE STUDY IB:

6.3.1 Background

IB, a 59-year-old right handed woman, was seen in the St Thomas’ Neuropsychiatry and Memory Disorders Clinic in November 2005 after she was referred by her GP due to concern about memory problems. She stated that since December 2004, she had experienced frequent confusional states associated with getting lost and not knowing what to do with familiar objects, such as a bank cheque or her washing machine. She described hallucinations as though she was on television or that people from television were coming into her room. IB reported word finding difficulties and poor comprehension of words, and progressive memory problems, including forgetting appointments. An MRI scan in February 2006 indicated several small subcortical lesions in both parietal lobes consistent with small vessel disease. There was also suggestion of hippocampal and temporal lobe atrophy. A PET scan conducted in July 2006 indicated significant bilateral temporo-parietal reduction in FDG uptake. In February 2006, she scored 19/30 on the Mini Mental State Examination. Neuropsychological assessment, conducted by Dr Eli Jaldow (see Appendix 6), suggested a significant deterioration in intellectual functioning in both the non-verbal and verbal domains relative to estimated average premorbid levels of functioning. Memory was globally impaired, for both verbal and non-verbal material across recall and recognition paradigms. Naming was poor and executive functions were impaired, with poor mental flexibility and conceptual reasoning. On the basis of information from her presentation, history, brain imaging and neuropsychological assessment IB was diagnosed with probable AD.

IB also had a history of hypothyroidism and elevated cholesterol. She had sustained a mild traumatic brain injury in December 2004. She described long standing hypervigilance following an alleged attack in Brussels in the mid-1980s. At the time of referral to the Memory Aids Clinic she was on Donepezil 5mg daily.

IB had left school at the age of 15 without completing any exams. She stated that she had been ‘slow at speaking’ when she started school, although she did not elaborate on this, and she had failed her 11+ exams. After working in a steel mill office, IB moved to Brussels to look after horses where she re-commenced her education via
correspondence. IB had eventually completed a two year degree in French Literature at the Sorbonne in Paris. She also began an MSc in Economics, which she completed in Cambridge. IB had worked in business in investments and at UCL as an economics lecturer. IB had been retired on medical grounds due to her memory difficulties. IB had a long term relationship with a political writer who now lived in Argentina. IB described a number of friends and stated that she also spent time with her sister, who lived near Leeds.

6.3.2 Memory Aids Clinic Presentation
IB was referred to the Memory Aids Clinic from the St Thomas’ Neuropsychiatry and Memory Disorders Service. She presented with complaints of difficulty remembering what she had to do and what she had done. She gave the example of recently missing an appointment with a friend. IB stated that her friends regularly phoned her to remind her of appointments and daily plans. She stated that she also forgot conversations and had difficulty understanding what people said. IB stated that she had difficulty finding her way around her usual environment. She described difficulty reading a clock and stated that she had to ask people to tell her the time, including strangers outside her house. She reported poor judgment of the time of day and difficulty writing. IB felt that she became easily confused and that her ‘brain fills up’ in complex, unfamiliar situations. She denied symptoms of low mood or anxiety.

IB described the use of a limited number of memory aids at the time of referral. She felt that she was ‘more organised’ but, when asked, felt that a simplified system would be beneficial. IB used a diary to record appointments and what she had done. This was located in her kitchen and she that although it worked well, it was limited in function as the diary remained within her house. Otherwise, IB only used a clock alarm and the memory strategies of mental retracing or leaving items in set places to find her belongings.

6.3.3 Baseline Neuropsychological Assessment
IB’s scores on baseline neuropsychological assessment are listed in Appendix 6. Premorbid level of functioning was estimated to have been in the average range. Performance on a short form of the Wechsler Abbreviated Scale of Intelligence estimated that IB was functioning in the low average range. This suggests a mild
deterioration in intellectual functioning from premorbid levels. Memory was impaired. Performance on an ecological test of memory function (RBMT-E) was in the impaired range, with particular difficulty on delayed recall tasks, prospective memory, and non verbal recognition. Indeed, performance on a test of prospective memory was in the impaired range and performance was not assisted by the availability of memory aids on this task. Attention and concentration skills were impaired. Speed of cognition was slow and auditory verbal working memory was impaired. Concentration was weak, and performance on this task was marred by impulsive behaviour. IB was unable to cope with the demands of a divided attention task. Executive functions were poor, with impaired planning.

On a self-report questionnaire, IB indicated a moderate degree of depressive symptoms. She reported a severe degree of retrospective and prospective memory problems, which were corroborated to the same degree by an informant.

6.3.4 Intervention
IB initially stated that her goal was to return to work. Information was provided about the focus of the MAC and the utility of identifying small steps to attain long term goals. When goal setting was reframed in this manner, IB then identified three treatment goals for the MAC. These were

1. to remember what she had been told,
2. to not have to go back and check whether she had completed a task,
3. to remember her future plans.

Prior to addressing her goal of remembering future plans, IB’s current memory aid use was reviewed, including her diary use and where her memory aids were located. IB stated that her diary ‘runs my life’ and was located in her kitchen where she referred to it in the morning. To establish a fixed, home-based memory aid system IB was provided with and trained in the use of a dry wipe message board. The board was divided into four sections of things to do today, things to do soon, appointments and other. Information to be written on the board included details of appointments, daily tasks and future plans. The board had an adhesive backing and IB planned to secure the message board onto her refrigerator. Use of the message board was supplemented with coloured pens and Post- it notes.
The message board was trained with the use of the training protocol as listed in Appendix 4. The components and use of the board were first described to IB with a visual demonstration of each part. IB was then asked specific training questions to ensure that she acquired knowledge about the components and function of the message board. Training was conducted under error reduction conditions. If she did not know the correct answer to the training questions, she was encouraged not to guess and the correct information was provided by the neuropsychologist. IB had difficulty reiterating this information, even without the demand for verbatim responses. She required up to three learning trials before she was able to give only approximate responses to the training questions. There was also evidence of perseveration on the topic of where the message board was to be located. Application of the message board to her everyday life was facilitated by in-session examples, using her message board. IB was also provided with written material about how to use the message board (see Appendix 4).

At the second session, use of the message board was reviewed. IB expressed some worry that it would remain blank since she did not do many activities during the week. However, she was motivated to use the board and stated that she had been using the board like a calendar for her social engagements. She also felt more comfortable using the message board after she had seen one listing procedures for harnessing horses at a local stable. IB’s knowledge of the components and application of the message board were trained with repetition of the training protocol across sessions two and three. She was able to provide correct information with less hesitancy or don’t know responses on both sessions. Use of the message board to address her other goals of keeping track of tasks and remembering what she had been told was introduced. Using the training protocol, IB was directly instructed to make a note on the whiteboard of phone messages and conversation, in addition to using Post-it notes throughout the house which were to be transferred to the message board. She was also asked to record a ‘to do list’ to keep track of tasks, including notes to indicate where she was up to when interrupted. IB became anxious at the notion of an additional memory aid system (a portable diary or Filofax) for when she was out of the house. She felt that this would be too confusing, too much to ‘take in’ and instead she expressed a preference for focusing on the use of the message board.
IB complained that she had difficulty keeping track of tasks. She stated that she often became distracted and began another task, only to forget what she was initially doing. She felt that this difficulty was compounded by difficulty with keeping track of time. Thus, although keeping track of the time was not nominated as a goal for the Memory Aids Clinic, this difficulty was addressed to support her goal for keeping track of tasks. IB wore an analogue watch but described difficulty with reading the clock face. The watch did not contain information about the date. She overcame this problem by asking strangers in the street for the correct time or leaving her home very early to attend appointments. Difficulties orienting to the time and date may have also compounded her difficulty with remembering plans. IB was provided with a talking calendar alarm clock to supplement her use of the message board to support her goals of remembering future plans and keeping track of which tasks she had completed. The talking clock was obtained from the Royal National Institute for the Blind (http://www.rnib.org.uk) and announced the time, date and day following a single button press. Instructions were attached to the clock (a large red rectangular box) for IB to press one button for the time and another button for the date and day. She was instructed to place the box next to the message board. Use of the calendar clock was practised in session under error reduction conditions. IB was also provided with a talking wristwatch. The talking watch stated the time and date. Its use was also trained in session under error reduction conditions.

IB’s compliance in using the message board was assessed by asking her to take a photograph of it in her kitchen as a between task homework assignment. IB was provided with a Polaroid instamatic camera to take the photograph. Written instructions and practice using the camera were conducted at the end of the first session.

To facilitate regular review of the message board and record compliance, at the second session IB was given a seven day diary with four nominated times. At each time, she had to look at the message board and then tick the corresponding box in the diary. IB was compliant in completing this diary for a period of 11 days, including notes on when she had failed to look at the diary at the specified time and when she had referred to the board at additional times. To further encourage application of the
message board to her everyday life, at the end of the second session, a homework assignment of making three phone calls to the neuropsychologist was set. There was no specific topic for the phone calls however it was presented as a realistic function for the message board. This assignment was also successfully completed.

To monitor use of the memory aids, two phone calls were made to IB during the follow-up period. The first monitoring phone call was made approximately one month following the end of training. IB stated that the talking calendar clock was ‘the best thing’ and stated that she used it successfully in conjunction with the message board. She stated that she did not have many activities on the message board. However, she felt she was less reliant upon her friends to remind her of her appointments and plans. IB also stated that the talking watch was ‘good’. Although she did not always use it, she was aware that the memory aid was available for support. Interestingly, IB reported increasing periods of confusion where she was ‘not quite sure what she was doing’. These episodes were associated with increased anxiety as she wondered whether ‘things might fall apart’. Information about these episodes was conveyed to her primary care team.

A second monitoring phone call was conducted approximately two months after the end of training. IB stated that she had conducted a ‘shake up’ of the message board and found that she now relied increasingly on her diary and her friends. She did continue to use the message board for appointments. In addition, she now reported that the watch was difficult to hear when there was background noise. IB continued to lavish praise on the calendar clock describing it as ‘wonderful’ and reporting that it had improved her ‘quality of life’. She found that if she was in a confused state, the talking clock made her feel more ‘stable’.

6.3.5 Results
As can be seen in Figure 14, at baseline, IB achieved her goals with an overall success rate of 38 percent. Following training, this had improved to 62 percent, in keeping with progressive treatment group performance (t = -0.07, p = 0.47). However, at the three month follow-up, goal attainment had declined to 47 percent, in a similar pattern to other progressive subjects (t = -0.30, p = 0.38). At follow-up IBs performance remained above baseline levels and was not significantly different to group
performance. More specifically, following training, recall of what she had been told had improved from 38 percent to 57 percent. At follow-up there had been further improvement to 70 percent. IB’s ability to remember if she had completed a task had also improved at the end of training from 17 percent to 64 percent. However, this had declined at follow-up to 50 percent which remained above baseline levels. IB’s ability to remember her daily plans was 67 percent at baseline and was maintained at this level after treatment. Unfortunately, treatment gains were lost at follow-up as IB was only able to recall plans with a 20 percent success rate.

Figure 14: IB’s overall goal attainment at baseline, end of training and three month follow-up compared to overall progressive group.

There had been minimal change on formal neuropsychological assessment, as seen in Appendix 6. Memory remained severely impaired and IB performed at floor on tests of prospective memory, delayed story recall, non verbal recognition and route memory. More extensive assessment of prospective memory was not conducted at follow-up. Attention and concentration skills were again impaired, with weak concentration and slow visual tracking. Auditory-verbal working memory was severely impaired. On this occasion, IB was unable to complete a digit symbol substitution task. Executive skills were also severely impaired with poor planning.
Subjectively, IB reported deterioration in her memory and understanding since the end of training. She stated that she had a lot going on and felt that she could not remember her appointments. She stated that she was ‘never quite sure what I have to do’. IB also described poor memory for past events, as, for example, she could not remember the details of her mother’s recent funeral. She described difficulty understanding written information including notes she made in her diary, and felt that she was in a ‘fog’ a lot of the time. IB continued to use her message board for her shopping list but now relied more upon her diary for appointments. She stated that she had to check her diary and message board frequently and at times struggled to understand what she had to do. IB continued to use the talking clock, which she described as a ‘lifesaver’, and also her talking watch. She no longer left the house to ask the date and time from people in the street.

At follow-up, there was evidence that IB’s mood had improved (see Table 24). There had been a significant improvement on a self-report questionnaire, since she now reported only a minimal degree of depressive symptoms (RCI = -3.71). However, although IB reported on-going anxiety associated with her memory problems both at interview and on a self-rating scale, she did indicate a reduction in stress at home and in social situations at follow-up. There had been no change in her self-esteem (RCI = -1.167) following treatment. Whilst there had been no change in self-reported prospective and retrospective, an informant report suggested a mild improvement in retrospective and prospective memory following treatment. Interestingly, community participation had improved at follow-up as measured by the CIQ (RCI = 2.04). The CSI was not completed as she lived independently without a carer. IB did not complete the Problem Solving Inventory.

6.3.6 Long Term Review:
IB was referred again to the Memory Aids Clinic approximately two years after taking part in the programme to determine her suitability for use of a medication box with an alarm. It was an opportunity to undertake a long-term review of her memory aid use but did not constitute another treatment episode within the Memory Aids Clinic.
Table 24: IB’s performance on psychosocial questionnaires in the Memory Aids Clinic at baseline and follow-up.

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<tr>
<th>Questionnaires</th>
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<tr>
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<tr>
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Legend: BDI II = Beck Depression Inventory second edition, Rosenberg = Rosenberg self-esteem scale, PRMQ self = Prospective and Retrospective Memory Questionnaire, PRMQ other = PRMQ proxy ratings, CIQ = Community Integration Questionnaire, CSI = Caregiver Strain Index, TS = T score, n.t. = not tested.

Neuropsychiatric review had indicated that performance on the Addenbrooke’s Cognitive Examination was 48/100 and her MMSE was 17/30. Medication at the time of her referral was Memantine and Donepezil. IB was now supported at home by the local community dementia nurse, who had recently referred her to the local telecare team for the fitting of a smoke alarm and combined gas/carbon monoxide detector to allow her to continue to live independently in her own home.

IB presented as a neatly dressed woman who walked independently. She was disoriented to time and did not know the name of the hospital. With prompts she was able to provide some details of current news events. Spontaneous speech was characterised by word finding difficulties, including substitution and paraphasic errors, in addition to mild perseveration. There was subtle evidence of semantic difficulties as IB did not know what a ‘season’ was when orientation to time was assessed. Pragmatics were intact. Indeed, IB was pleasant and co-operative throughout the session. She denied symptoms of lowered mood or anxiety. However, IB admitted to a loss of confidence as a result of her memory problems and she
expressed concern about her prognosis asking ‘how long is it going to last?’ She stated that her plans for her retirement and her future have “all gone” due to her illness. She described feeling “threatened” by the memory and cognitive changes.

IB described on-going memory difficulties, with a variable memory for appointments, complicated by day and date confusion. She stated that she forgot daily tasks, for example if she went out she would forget what she had to do or where she had to go. It remained difficult for her to read a clock face. She felt that her memory for past events depended on what the event was and whether it was personally relevant. IB described difficulty processing and understanding spoken information. For example, she felt easily overwhelmed with information on medication provided by the community nurse, particularly if the nurse spoke quickly. IB reported feeling strange and ‘bizarre’ within her home, such that she would look at a household item, such as a dress, and wonder if it was hers. Although she was able to reason that it could not belong to anyone else, the feeling of strangeness persisted. IB also described difficulty coping with change to routine and stated that it now took her a long time to figure out how to work household appliances, including the stove. She had recently forgotten to turn off the stove and had almost let the bath over run.

IB stated that she continued to use her diary to recall what she had done and her daily plans. She stated that the talking calendar clock was the “number one thing” that helped with her everyday memory. She no longer used the message board or talking watch. IB did not independently identify any outstanding everyday memory goals. At the insistence of the referring agent, IB was given a Pivotell medication box with an alarm. Training was not attempted given the severity of her cognitive impairment rather, instructions were provided for the community nurse to set up the memory aid within IB’s home environment. These instructions included how to use IB’s daily routine to facilitate medication compliance and the importance of having a set place for the medication box. Ideally, such training would have been conducted within her home with her support team.

6.3.7Discussion
IB is a valuable case to present as she has diagnosis of probable Alzheimer dementia, lives alone, and was seen for a long term follow-up two years after conclusion of her
rehabilitation program in the Memory Aids Clinic. Whilst IB did show some initial gains in remembering what she had been told and keeping track of daily tasks, these gains were vulnerable, with some deterioration in goal attainment. This is a similar pattern to the previous case CC.

The most notable feature of IB’s presentation is her profound cognitive impairment, with poor memory, attention/concentration and executive functioning. In a similar manner to CC, she required the use of error reduction techniques to acquire skills in using memory aids, with the use of spaced retrieval to learn how to use her talking watch. Her baseline level of performance on everyday memory tasks was low, as shown in Figure 13. In spite of these significant impairments in the context of a progressive neurological condition, IB lived at home independently with minimal support from friends, family or support services. She did show and describe some benefit from the Memory Aids Clinic. It appears that during the training period she became more independent with her use of memory aids. IB relied more upon her message board and diary to remind her of appointments as opposed to asking friends. Importantly, with the use of the calendar clock she no longer had to approach strangers in the street to orient herself to date and time, thus decreasing her vulnerability. Performance on the CIQ indicated increased participation at follow-up.

Whilst the long term follow-up session did not constitute a formal treatment episode in the analysis of the Memory Aids Clinic, it is interesting to review anecdotally the benefits of training. There was qualitative and quantitative evidence of cognitive deterioration across the two year period. IB stated that she no longer used the message board and had reverted to the use of her diary- the memory aids she was using at the time of the initial referral. This suggests that the skills acquired in the Memory Aids Clinic were not consolidated into everyday life. Whilst additional sessions may have facilitated new learning, poor maintenance in the short and long term may also reflect the choice of memory aids for this cognitive impaired lady. It is interesting that she continued to use the talking calendar clock; a memory aid with a simple design and one basic function. Generalisation of skills acquired within sessions from the clinic to the home environment may be more difficult for people with more generalised cognitive difficulties (such as people with progressive diseases of old age). Training sessions within the home environment may be important for these clients to promote
both new learning and transfer, particularly in clients who have no support network to act as a co-therapist. The final case study of a participant with a progressive neurological condition illustrates the support of a carer as co-therapist in a man with goals including memory for past events.

### 6.4 CASE STUDY BB:

#### 6.4.1 Background

BB, a 65-year-old man right handed man, was referred to the St Thomas’ Neuropsychiatry and Memory Disorders service with complaints of a progressive deterioration in memory. In addition to memory problems, BB’s wife reported word finding difficulties and poor recollection of past events such as holidays.

BB had a 30 year-history of epilepsy. His generalised seizures had only ever occurred at night and were associated with tongue biting and incontinence. The seizures were well controlled at the time of the initial assessment. MRI conducted in July 2008 indicated prominence of the ventricles and subarachnoid spaces consistent with generalised cerebral volume loss. There was no small vessel disease despite BB’s history of precursor factors. Neurological examination in July 2007 documented a mildly ataxic gait, which may have been related to his long term use of anti-convulsant medication. Peripheral neuropathy and left neuralgic amyotrophy were also noted at this examination. BB also had a history of antiphospholipid syndrome, hypertension and recurrent deep vein thromboses. He was diagnosed with Mild Cognitive Impairment (MCI).

BB had completed ten years of education. He then worked as a construction engineer, a position which involved the repair of construction machinery. He retired in 2005 due to increasing memory and balance problems. He was married with two grown up daughters. BB enjoyed spending his time with family, in addition to travelling, gardening and reading.

#### 6.4.2 Memory Aids Clinic Presentation

BB presented with complaints of poor memory for both recent and remote past events, including holidays and his parents’ funerals. He described difficulty learning routes
when driving, even to places he visited often, as he had no recollection of his previous visits to these locations. BB reported poor memory for what he had read, with difficulty remembering the characters and the plot of a story, when he returned to reading after a break. He also stated that he misplaced belongings such as his glasses. BB’s wife concurred that her husband had memory problems and added difficulties in recalling plans and appointments. She stated that he forgot conversations and sometimes would ‘fabricate’ information that he had forgotten. She supervised his use of a dosette box to manage his medication and felt that he would forget if she did not assist him in this task.

BB did not feel that he was an organised person prior to the onset of his current memory difficulties. He used six different memory aids/strategies at the time of referral. These were a calendar, his mobile phone (although this was mainly for phone calls), a watch with the day and date on it, a dosette box, having set places for belongings and mentally retracing his steps if he lost something or forgot what he was doing. BB expressed ambivalence about using memory aids as he stated that he did not ‘like gadgets’ or ‘new technology’. He stated that at present he felt like ‘a fool’ and ‘a fraud’ because of his memory problems. When asked how he wanted things to be different following treatment in the MAC, BB stated that he wanted to be able remember things he did with his friends.

**6.4.3 Baseline Neuropsychological Assessment**

As shown in Appendix 6, premorbid level of functioning based upon a word reading test estimated that BB was functioning in the average range. Performance on a short form of the Wechsler Abbreviated Scale of Intelligence estimated that he was functioning in the average range, broadly commensurate with premorbid estimations. Memory was impaired. On an ecological test of memory function (RBMT-E) overall performance was impaired, with particular difficulty on tests of prospective memory, non-verbal recall, and recall of names. Prospective memory was poor, with inefficient use of memory aids. Attention and concentration skills were impaired. Concentration was severely impaired. Speed of cognition and auditory verbal working memory were in the borderline range. Visual tracking was in the low-average range. Divided attention skills were relatively intact. There was evidence of executive dysfunction, with poor planning and non verbal concept formation.
BB did not report symptoms of anxiety or low mood at interview. However, he endorsed a mild level of depressive symptoms on a self-report questionnaire. There was no significant difference between the level of retrospective and prospective symptoms reported by BB and his wife on a memory questionnaire. BB’s wife endorsed 11/16 items on a carer strain index.

6.4.4 Intervention
BB identified three goals for the MAC. These were:

1. To remember remote events (e.g. past holidays)
2. To remember what he had done each day
3. To locate personal belongings within the house

As noted previously, baseline measures of goal attainment were taken with the use of the memory diary to record his success in these tasks each day. He was asked to complete the diary with the assistance of his wife.

BB emphasised his desire to recall past (remote) events with friends and families. The initial session focussed on gathering information about those events BB wanted to recall. He nominated remembering holidays from the past five years as a starting point for the creation of a memory journal. Together with his wife, who attended sessions with BB, he was given a notebook in which to record details such as when, where, with whom and what happened. He was encouraged to write down notes following discussion with his wife, but to also include information such as postcards, photographs and other paraphernalia that he had kept from each holiday. These instructions were written in the memory journal, in the summary of his treatment session and reinforced with his wife. BB was encouraged to refer to the memory journal on a regular basis in a form of spaced retrieval. He was to also refer to the memory journal when in conversation with family about his past holidays. In this way, recall was to be prompted and supported by the information in the journal as opposed to effortful and errorful free recall.

To support his memory of past holidays, BB was also trained in the use of a talking photo album (see Appendix 4). This album held 24 four by six inch photographs and a
ten second message could be recorded to accompany each photograph. BB and his wife were to select additional photographs of holidays listed in his memory journal and to place these in the album and record a brief message describing when, where, with whom and what happened. Again, he was encouraged to review the talking photo album under errorless conditions such that he played the message for the information as opposed to free recall. He was encouraged to review the album on a regular basis, both by himself and with the support of his wife. Homework following the initial session was to develop both the memory journal and the talking album. BB was compliant in beginning these projects since he demonstrated his holiday photographs in the album during a review at the second training session.

To address his second goal of remembering what he had done each day, BB was provided with a ‘week-to-two-page’ diary. The diary was also presented as an aid to record information such as birthdays and anniversaries. BB was encouraged to record events at the end of each day noting the key points of when, where, with whom and what happened. These points were selected to reinforce information recorded in the memory journal and the headings were listed in the diary. Again, BB’s wife was encouraged to support his use of the daily diary principally by prompting him to make notes of events at the end of each day. The diary was to be kept in a prominent place within the house and not moved from this location. Use of the diary was reviewed in the following treatment session. BB remembered to bring the diary to the treatment session and had made appropriate notes throughout the week. Some birthdays had also been recorded in the diary. He kept the diary in the kitchen, in an area that was forming a ‘memory space’ with the location of a number of memory aids. His wife also provided positive feedback of her husband’s use of the diary to record daily events.

BB reported that he misplaced belongings within the house, most commonly his keys and his glasses. To help him find his glasses, BB was given a cord to attach to his glasses to hang around his neck. He was reluctant to use such a memory support and eventually selected his preferred style of glasses cord from a selection on offer in the Memory Aids Clinic display centre. To locate his keys, BB was trained in the use of a ‘Smart Finder’. This memory aid is made up of a transmitter and four receivers. The transmitter has four colour coded buttons; next to a button is a picture of a key or
phone/remote control. There are four colour matched receivers to attach to commonly misplaced items. BB’s keys were attached to one of the receivers. According to the training protocol, BB was told how to press the button on the transmitter that corresponded to his keys to locate his keys when lost. The neuropsychologist then demonstrated how to use the Smart Finder to activate the receiver and find the keys. Finally, BB practised using the Smart Finder in session to locate his keys. He was told not to guess if he did not know the correct sequence; however, he was able to use the memory aid without difficulty. An important component of the Smart Finder training included nominating a place for the transmitter. BB and his wife stated that the transmitter would be located in the ‘memory space’ in the kitchen for ease of use if the keys were misplaced. He was also provided with written instructions for the Smart Finder. General strategies for locating objects, including being organised, reducing clutter and having set places for belongings, were also discussed.

During the treatment sessions, BB reported that he was increasingly forgetting to take all that he needed with him as he left the house and that he also forgot to close/lock doors, which posed a security hazard. To prompt him to take his keys, wallet and phone with him as he left the house and to ensure that he closed the door, he was trained in the use of a ‘Memo Minder’. This is a small portable motion sensitive device on which a reminder of up to 20 seconds was recorded. A message asking BB to take his belongings with him and to close the door was recorded by the neuropsychologist. BB and his wife were also instructed how to record a message as described in the training protocol (see Appendix 4). Training emphasised the location of the Memo Minder, trouble shooting and the settings of the device. Following discussion of the Memo Minder features and function, use was demonstrated by the neuropsychologist. BB was then asked the training questions and practised recording a message under error reduction conditions. He was able to perform these tasks without error although he required two trials to successfully record a message.

During discussion of memory aids and strategies to remember past holidays and daily events, BB and his wife expressed interest in support for prospective tasks, including what he had to do each day, and a means of recording messages. He was provided with and trained in the use of a dry wipe message board. The board was divided into sections for each day of the week, for urgent tasks and phone messages. The focus of
the board was to record future events and phone messages. The message board was placed in the kitchen to facilitate regular review and to complement the other memory aids. Its use was supplemented with coloured pens, Post-it notes and magnets to attach additional correspondence. Components and use of the message board were initially described to BB following the key training points as listed in Appendix 4. Once these verbal instructions had been presented, the neuropsychologist demonstrated the use of the various components. BB was then asked the specific training questions under error reduction conditions and he practised using the board. He did not have any difficulty acquiring knowledge of the board’s components or function. Training was conducted in the presence of his wife to facilitate transfer of the memory aid to the home environment. Generalisation was also encouraged by discussion of hypothetical situations in which the board could be used to support prospective tasks. BB was also provided with written information on how to use the message board. He was asked to take a photograph of the message board to determine his compliance with the memory aid, and he was provided with a Polaroid camera to complete this task. The photograph showed a detailed, organised amount of information on the board, with notation to indicate completed tasks.

6.4.5 Results

Overall, at baseline, BB attained his goals with a 56 percent success rate (see Figure 15). Goal attainment improved following training to a level of 80 percent, similar to other progressive subjects (t = 0.77, p = 0.23). At follow-up, although there had been a mild decline in goal attainment to 67 percent this remained above pre-treatment levels, in a similar pattern to the progressive treatment group performance (t= 0.58, p = 0.29). More specifically, following training BB did not report any difficulty remembering what he had done each day or locating belongings. There had only been a limited improvement in his ability to remember past events, which had increased from 33 percent to 42 percent. At follow-up, BB continued to remember what he had done each day and the location of his belongings without difficulty. However, at follow-up he recorded that he was unable to remember any past events.

At the follow-up interview, BB stated that he routinely made notes of his daily activities each evening which allowed him to ‘remember things I could not have remembered before’. He stated that he used his diary every day to refer to specific
details and he felt that this was the most useful memory for retrospective events. BB stated that he did also use the talking photo album and journal. However, he did not use these supports as often as his diary and he had not completed information on all of his holidays for the past five years. He stated that when he did review the album or journal, it did support his memory for these events. BB also reported that the ‘Memo Minder’ continued to be useful and that he used the message board for important things he had to do, such as appointments. He expressed on-going frustration and annoyance that he could not remember and that he had to rely on the diary.

Figure 15: BB’s overall goal attainment at baseline, end of training and three month follow-up.

6.4.6 Follow-up Assessment
Review neuropsychological assessment suggested a mild degree of deterioration in prospective memory and executive function (see Appendix 6). Memory remained impaired, with on-going difficulty in non-verbal recognition memory, route memory, name recall and prospective memory. Indeed, performance on a test of prospective memory had deteriorated and was now in the impaired range. Attention and concentration skills were again weak. On this occasion, visual tracking was in the impaired range. Speed of cognition was again in the borderline range. However,
auditory verbal working memory was in the average range and divided attention was relatively intact. Performance on a test of concentration was contaminated as BB counted a series of tones by using his fingers. Executive function had deteriorated. Planning was again impaired and on this occasion BB was unable to complete a test of non-verbal concept formation. Qualitatively, there was increased evidence of perseverative thinking and difficulty understanding complex task instructions.

Performance on psychosocial measures is shown in Table 25. There had been no change in BB’s mood, as he again reported a mild degree of depressive symptoms on a self-report questionnaire. There had been no significant change in self-esteem as measured by the Rosenberg Self Esteem Scale. At follow-up, BB’s wife now reported significantly worse retrospective memory difficulties than her husband’s self-report and there was a trend for BB to note less significant retrospective memory problems in general. There had been no change in BB’s level of community integration. His wife continued to endorse 11/16 items on a carer strain index.

**Table 25: BB’s performance on psychosocial questionnaires in the Memory Aids Clinic at baseline and follow-up.**

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<td><strong>TS = 24</strong></td>
</tr>
<tr>
<td><strong>PRMQ- self retro</strong></td>
<td>32</td>
<td><strong>TS = 23</strong></td>
</tr>
<tr>
<td><strong>PRMQ- self total</strong></td>
<td>65</td>
<td><strong>TS = 22</strong></td>
</tr>
<tr>
<td><strong>PRMQ- other pro</strong></td>
<td>33</td>
<td><strong>TS = 27</strong></td>
</tr>
<tr>
<td><strong>PRMQ- other retro</strong></td>
<td>36</td>
<td><strong>TS = 20</strong></td>
</tr>
<tr>
<td><strong>PRMQ- other total</strong></td>
<td>69</td>
<td><strong>TS = 21</strong></td>
</tr>
<tr>
<td><strong>CIQ</strong></td>
<td>7/29</td>
<td></td>
</tr>
<tr>
<td><strong>CSI</strong></td>
<td>11/16</td>
<td></td>
</tr>
<tr>
<td><strong>Subjective</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Memory</strong></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td><strong>Stress</strong></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Home</strong></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Social</strong></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td><strong>Work</strong></td>
<td>n.t.</td>
<td></td>
</tr>
</tbody>
</table>

**Legend:** BDI II = Beck Depression Inventory second edition, Rosenberg = Rosenberg self-esteem scale, PRMQ self = Prospective and Retrospective Memory Questionnaire, PRMQ other = PRMQ proxy ratings, CIQ = Community Integration Questionnaire, CSI = Caregiver Strain Index, TS = T score, n.t. = not tested.
BB’s responses on the Problem Solving Inventory (PSI) at the end of treatment suggested that he was aware of the application of memory aids in a variety of situations. As can been seen in Table 26 he noted 17 memory aids for use across the 19 situations, which reflected eight different aids or strategies. He had not completed the PSI at baseline. BB’s awareness of memory aid use appears to have declined over time as at follow-up he only suggested the use of seven memory aids across the hypothetical situations presented on the PSI.

**Table 26: BB’s performance on the Problem Solving Inventory in comparison to treatment and control subjects with a progressive condition.**

<table>
<thead>
<tr>
<th></th>
<th>BB</th>
<th>Treatment group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>End of Treatment</td>
<td>Follow-up</td>
</tr>
<tr>
<td>Memory Aids</td>
<td>n.t.</td>
<td>17</td>
<td>7</td>
</tr>
<tr>
<td>(mean, S.D.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Baseline</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(n = 12)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Follow-up</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(n = 12)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Baseline</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(n = 6)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Follow-up</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(n = 6)</td>
</tr>
<tr>
<td>Memory Strategies</td>
<td>n.t.</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>(mean, S.D.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Baseline</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>(n = 6)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Follow-up</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(n = 6)</td>
</tr>
<tr>
<td>Different aids/strategies</td>
<td>n.t.</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>(mean, S.D.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Baseline</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>(n = 6)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Follow-up</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(n = 6)</td>
</tr>
</tbody>
</table>

Legend: S.D. = standard deviation, n.t. = not tested.

**6.4.7 Discussion**

In contrast to the previous cases in this chapter, BB demonstrated improvement in two of his everyday memory goals following training in the Memory Aids Clinic. These gains were maintained over time, although there was evidence of deterioration in memory on formal testing over time. However, this pattern of performance is obscured by a poor memory for past events, such as holidays. His ‘success’ may reflect his diagnosis of MCI as opposed to Alzheimer dementia, although there was evidence of impaired memory, attention and executive function on formal testing, with greater maintenance of goal attainment across time. Higher levels of goal attainment may also reflect higher motivation and carer support, particularly as carer involvement has been identified as a predictor of successful memory aids use in
people with dementia (Schmitter-Edgecombe et al., 2008; Clare et al., 2010) although qualitative differences in the level of support between CC and BB were not examined.

The case of BB is notable as his treatment addressed goals of retrospective as opposed to prospective memory tasks. He aimed to improve his memory for remote events, such as holidays, and what he had done during the day. Although BB had not previously used a diary, he was able to learn how to effectively use this memory aid to remember what he had done each day. Although he had severe and generalised cognitive impairment he was able to learn new skills without additional use of error reduction techniques. BB was supported in his rehabilitation by his wife, who effectively acted as a co-therapist to facilitate application of skills to the home environment.

BB’s overall success was masked by his poor use of a memory journal to remember past holidays. Integration of this journal into his everyday life could have been improved by the use of formal homework exercises asking questions about his holidays or important events/social occasions that occurred during the training period. Greater education and support regarding how to adjust to this different experience and the role of memory aids in helping to supporting retrospective memory could have led to greater involvement and use of the journal. BB’s goal of remembering past events could also have been supported with the use of Vicon Revue. Although this would not have helped him to remember events in the remote past, use of the camera could have supported consolidation of future events (Berry et al., 2009).

6.5 **General Discussion**

There is growing evidence for the use of neuropsychological rehabilitation interventions to support the everyday functioning of people with progressive neurological conditions, such as Alzheimer’s dementia and MCI. However, comparison of progressive and non progressive subjects in the treatment group indicated that there was no significant effect of treatment in the Memory Aids Clinic for subjects with a progressive condition. This case series analysis sought to describe in more detail the training techniques used with progressive subjects and to illuminate factors that may have undermined their ability to benefit from training in the Memory Aids Clinic. CC and IB performed below the control group in terms of goal
attainment; any initial treatment gains they made relative to their own baseline were not maintained across time. BB had gains in some aspects of everyday function masked by poor recall of remote events at follow-up.

The progressive subjects presented in this case series all had severe and generalised cognitive impairments in contrast to the memory performance of the non-progressive cases presented in chapter 5. Interestingly, all of the subjects with a progressive condition presented in this case series required training using error reduction techniques; techniques which have been shown to be effective in training people with MCI to use memory aids (Clare, 2008; Cahill et al., 2007). It has been suggested that error reduction techniques are more effective in supporting new learning in subjects with impaired explicit memory (Middleton & Schwartz, 2012) as was the case for CC, IB and BB. The structure of the Memory Aids Clinic allowed a flexible approach to neuropsychological rehabilitation. As opposed to prescribing a specific memory aid, supports were personally selected according to each participant’s goals and trained systematically according to their cognitive profile. This flexibility stands in contrast to programs evaluating the application of specific memory aids such as notebooks or voice recorders and reflects an attempt to consider the rehabilitation of progressive neurological conditions within a bio-psycho-social framework (see Clare, 2008).

With severe memory difficulties and additional executive impairments, the three training sessions offered in the Memory Aids Clinic may not have been of sufficient intensity to support new learning. Successful neuropsychological rehabilitation interventions for people with progressive conditions have consisted of eight sessions focussing on two to three goals (Clare et al., 2009; Clare et al., 2010); 13 sessions with a focus on one goal (Lekeu et al., 2002) and 12 (Greenaway et al., 2012) or 14 sessions (Schmitter-Edgecombe et al., 2008) to learn to use a memory notebook. Additional sessions in the Memory Aids Clinic may have provided more learning trials to acquire the skill of memory use, highlighting the importance of a carer/spouse to act as co-therapist. Subjects with a progressive condition may have also benefitted from training within the home environment to help them successfully apply and generalise skills from the clinic to a more naturalistic setting given greater cognitive impairments. Booster sessions across a longer follow-up period may have been of assistance to maintain treatment effects for progressive subjects.
There was evidence of deterioration on formal neuropsychological measures for IB and BB over time. This may have underpinned poor maintenance of treatment gains for IB. The case of BB is not as straightforward as he was able to maintain treatment gains for two of his goals. Again, as with the case series of participants with a non-progressive neurological condition, some rehabilitation goals proved to be more amenable to the use of memory aids. Memory for verbal instructions and conversations (CC) was poorly addressed as was BB’s goal of remembering past events. In the latter case, the use of Sense Cam/Vicon Revue may have allowed BB to retain memories of important events (see Berry et al., 2009).

At follow-up, there was evidence of changed awareness of memory difficulties with discrepancies on the PRMQ self and other ratings for BB and CC. IB did not complete this questionnaire. Changes in insight as part of a progressive condition could have a negative impact on continuing to use a memory aid. With time, change may occur to an individual’s understanding of why a memory support is needed or to their awareness of situations in which a memory aids should be applied (Prigatano, 2009; Van den Broek, 2005). Additional sessions for participants with a progressive condition may have explored awareness of impairments and subsequent anticipation of when a memory support may be required (see Barco et al., 1991). Poor outcome for progressive subjects may have also reflected the use of the memory performance diary to record outcome. It is possible that the participants did benefit from the treatment but, given reduced awareness, they may not have been able to appreciate such a gain (Koltai, et al., 2001). Recruitment of carers to record a proxy rating of everyday memory performance may have circumvented this problem.

Unfortunately, measurement of generalisation of training with the Problem Solving Inventory is incomplete in this case series. IB did not complete the questionnaire. CC’s performance did not change across training and he did not complete the questionnaire at follow-up. BB did not complete the PSI at baseline, and his performance deteriorated from the end of training to follow-up. Previous studies into memory and cognitive rehabilitation for people with MCI or early Alzheimer’s dementia have had some success with a group format teaching general strategies including using memory aids, education about memory and internal strategies such as
visualisation or face-name learning (Clare et al., 2010; Kinsella et al., 2009). Troyer et al (2008) describe a similar group program focussing on everyday memory that generalised to improved performance on a list of hypothetical memory scenarios. It may be that people with progressive conditions can benefit from the use of memory aids if training is presented within a more general practically focussed program to provide a context for additional, individualised cognitive rehabilitation.

Neuropsychological rehabilitation of people with progressive neurological conditions remains challenging. Although participants with progressive conditions in the current study did not benefit significantly from training within the Memory Aids Clinic, this may reflect the current structure of training. Systematic training was conducted across three sessions in an outpatient clinic setting. However, it is premature to advise against the systematic training of memory supports for this subject group. Memory aids training for participants with a progressive neurological condition may need to be more flexible to take into account their cognitive profile, to allow adaption of memory aids to support individual needs and allow the use of error reduction techniques as required. Three training sessions does not appear to be of sufficient intensity and regular follow-up, possible home visits to maximise environmental support, and exploration of insight and adjustment may all maximise the effect of training within this group.
7 DISCUSSION

7.1 Outline of Discussion.
There is a growing body of literature to support the effectiveness of memory aids to compensate for acquired memory disorders and improve the everyday functioning of individuals with acquired brain injury. The current study examined the systematic training in the use of memory aids on everyday memory function, neuropsychological performance and psychosocial functioning. This chapter discusses the findings of the Memory Aids Clinic treatment in each of these domains. The measurement of outcome in neuropsychological rehabilitation and in the use of memory aids is then considered. The contribution of the current study is then discussed in terms of a systematic approach to training memory aids. I will then propose the key elements of such a training program based on the current findings and a synthesis of the literature.

7.2 Summary of findings
The current study investigated the effectiveness of the systematic training in the use of compensatory memory aids on the everyday memory function of people with acquired memory disorders. Comparison was made between 63 subjects in the treatment group and 28 subjects in a waiting list control group. The clinical sample had a heterogeneous mix of neuropsychiatric disorders, reflective of typical referrals to the St Thomas’ Neuropsychiatric and Memory Disorders clinic and neurological outpatient clinics (Kopelman & Crawford, 1996). The treatment program was comprised of a baseline assessment and goal setting; three training sessions and a follow-up assessment. Memory aids were selected to support everyday memory goals and instruction was based on Sohlberg and Mateer’s (1989) model which focused on the acquisition, application and adaptation of new skills. The training program also incorporated principles of behavioural modelling and errorless learning; compliance was assessed between sessions. Subjects randomly allocated to the control group received written information about the management of memory problems, prior to commencing treatment 18 weeks after the baseline.

The systematic training of compensatory memory aids with the Memory Aids Clinic protocol was effective in improving attainment of everyday memory goals. However,
this treatment effect was only evident at follow-up. Following training, there was no difference between the everyday memory performance of the treatment and control group. At follow-up, relative to the deterioration in memory performance of the control group, participants in the treatment group had maintained the improvements in everyday memory performance observed at the end of training. Analysis at the individual level indicated a significant effect of treatment from baseline to the end of training, suggesting an effect obscured by the averaging of group data. Overall group analysis did not indicate any transfer of the effects of training to the performance on neuropsychological tests. There was also no effect of training in the Memory Aids Clinic on the psychosocial measures of mood, self-esteem, participation, and subjective memory functioning or carer strain. Training did however generalise to the Problem Solving Inventory, suggesting adaptation of skills to similar but diverse memory scenarios.

The clinical sample included subjects with either a non-progressive (e.g. people with a diagnosis of traumatic brain injury, stroke, hypoxic brain injury, encephalitis or seizure disorder) or a progressive neurological condition (e.g. MCI, Alzheimer’s dementia or multiple sclerosis). Additional analyses were conducted to examine the performance of the non-progressive subgroup and of the progressive subgroup. The benefit of systematic training for people with non-progressive memory conditions was confirmed with a significant treatment effect at the end of training when compared only with control subjects with a non-progressive condition. The positive effect of treatment on everyday memory performance was maintained across time. In contrast, there was no improvement in everyday memory performance for participants with a progressive condition following training or at follow-up when compared with progressive control subjects. However, subjects with a progressive condition did endorse the use of a higher number of memory aids on the Problem Solving Inventory. This suggests that training was generalising to other applications of memory aids although they were not able to benefit from a focussed acquisition of skills, similar to findings demonstrated in memory group programs for people with progressive neurological disorders (Troyer et al., 2001; Kinsella et al., 2010).

A final analysis comparing the everyday memory performance of treatment group participants (non-progressive vs. progressive) highlighted the beneficial effect of
training memory aid use for subjects with a non-progressive condition. Attainment of
everyday memory goals was higher for subjects with a non-progressive condition
after treatment and this effect was maintained over time. The lack of benefit of
memory aids for subjects with a progressive condition is in contrast with recent
literature. Memory aids have been incorporated into successful goal directed
rehabilitation programs for people with early AD (Clare et al., 2010) and MCI (Clare
et al., 2009), including rehabilitation programs utilising Sohlberg and Mateer’s (1989)
acquisition, application and adaptation approach to training (Greenaway et al., 2008;
Greenaway et al., 2012). The current findings suggest that people with progressive
conditions may require more intensive rehabilitation across more sessions (Elhardt et
al., 2012), particularly given the poorer memory and executive function within the
current sample of subjects with a progressive condition. Again, progressive subjects
endorsed the use of more memory aids on the Problem Solving Inventory suggesting
that these participants were benefitting from the Memory Aids Clinic in a different,
more general way than the subjects with a non-progressive condition.

Case series analyses were provided to illustrate the training of memory aids in more
detail and to address issues pertaining to the content and outcome of treatment. The
case series describe how each memory aid was trained using errorless learning, space
retrieval, compliance measures and homework. This required a detailed knowledge of
available memory aids and a detailed analysis of how each memory aid worked to
develop a specific training protocol, including compliance and homework measures. It
was revealed that some memory problems are not currently served well by memory
aids, such as remembering what has been read in case JG. The case series highlighted
the use of meta-cognitive techniques to raise awareness of when a memory aid should
be used, such as in the use of a modified form of Goal Management Training (Levine
et al., 2000) for WR. The case series of subjects with a progressive condition
indicated that training gains were fragile and not maintained. These subjects may have
benefitted from treatment within their home environment to facilitate transfer
(Prigatano & Kime, 2003) and more sessions may have consolidated the suggested
initial treatment gains. The Memory Aids Clinic was presented within a holistic
rehabilitation framework which was challenging to maintain within three sessions.
Collaborative goal setting, education about memory, and acceptance of memory aid
use were key elements of the training program. Use of family members as co-
therapists was notable in the progressive case series, possibly supporting these individuals with greater cognitive impairment, and greater involvement of a significant other may have enhanced the validity of outcome measures (see Limoncello et al., 2011). In addition, the successful outcome in case LB and WR, and even that of BB, may have been better captured by a measure of self-efficacy (see Cicerone et al., 2008) to demonstrate their perceived mastery and confidence of using memory aids following training.

7.3 Outcome Measures

7.3.1 Memory Aids Clinic Outcome as measured by the Memory Diary

The main outcome measure of the Memory Aids Clinic was a memory diary, developed for the current study, which acted to record success in everyday memory goal attainment. Subjects were required to indicate success on their nominated goals each day, similar to records of goal attainment in the evaluation of the electronic pager Neuropage (Wilson et al., 2001) and the use of mobile phones as a memory aid (Wade & Troy, 2001). Everyday memory performance was measured with the diary at baseline, the end of treatment and at follow-up. There was no significant difference in goal attainment as measured by the memory performance diary between groups from the baseline to the end of training. Both the treatment and control group improved performance across time. However, the treatment group maintained improvements in goal attainment at the time of follow-up, compared to a decline in performance within the control group. More specifically, at follow-up goal attainment was significantly higher in the treatment group than the control group. Analysis at the individual level confirmed a treatment effect with more subjects in the treatment group increasing attainment of everyday memory goals following training and maintaining these gains at the time of the follow-up assessment.

At baseline, control subjects were given written information about managing memory problems in the form of the Cambridge Memory Manual (Kapur, 2001). Improvement in goal attainment for control subjects may have reflected the combination of advice in this manual, therapist input at the initial assessment, including acknowledgement of their difficulties, goal setting and the promise of treatment. The process of collaborative goal setting at baseline and memory diary review six weeks later may
have been sufficient to change monitoring behaviour of memory goals to reduce the functional impact of memory problems (Jeong & Cranney, 2009). It may also be possible that control subjects everyday memory performance improved as a result of improved awareness of memory aids and strategies described in the Memory Manual. This possibility could have been explored by formally assessing the control groups understanding of the information presented in the Memory Manual. Use of adequate control groups in rehabilitation research is challenging as it is ethically difficult to withhold treatment. In the current study, even the minimal contact at baseline and six week later may have obscured any group differences from baseline to the end of training. Ideally, treatment in the Memory Aids Clinic could have been compared to a no treatment group or to a treatment as usual (outpatient rehabilitation without a specific memory aids focus).

Collaborative goal setting underpinned the utility of the memory performance diary as an outcome measure for the Memory Aids Clinic. In the baseline assessment session, all subjects were asked to identify those areas of everyday memory functioning that they would like to address in the clinic. This was facilitated by completion of a modified version of the Everyday Memory Questionnaire (EMQ; Sunderland et al., 1983) and clinical interview. The development of goals collaboratively aimed to increase the personal relevance of the goal and thus improve goal performance and commitment to the treatment (Wade, 2009; Locke & Latham, 2002). An attempt was made to establish SMART goals that were ‘Specific, Measurable, Achievable, Relevant and Timed’ (Bovend’Eerdt et al., 2009). For example, the Memory Aids Clinic goal of remembering to take medication at the right time, was specific, measured by the memory performance diary (and sometimes the memory aid), able to be achieved with the support of training, important to the participant and was to be monitored across the period of involvement in the clinic. Establishment of more specific goals within the Memory Aids Clinic may have facilitated higher goal attainment and so a stronger treatment effect. For example, some participants’ goals were vague, such as ‘to be more confident’ or ‘to be more organised’ (see Table 2, chapter 2). Accurate recording of goal attainment may have been facilitated by specifying how increased confidence or increased organisation was functionally defined.
Goal setting allows the outcome of a rehabilitation program to be measured effectively. The memory performance diary was developed for the current study on the basis of the outcome measure used in the Neuropage evaluations (Wilson et al., 2003). Measurement of outcome in rehabilitation is difficult due to the heterogeneity of patients and of desired treatment outcomes (Wilson, 2009, Turner-Stokes, 2009). This was reflected in the heterogeneity of clinical sample in the Memory Aids Clinic participants with the identification of 24 different goals. The memory performance diary aimed to capture these individual goals as opposed to a one size fits all measure whilst providing a quantitative measure of performance with good ecological validity. The definition of success each day was defined following Kime’s (2006) recommendation that if a response is not 100% accurate, then the compliance measure should be marked ‘No’ so as to facilitate learning of the correct behaviour. Thus, the positive results of the current study are robust and reflect successful goal attainment, as partial success was scored as a ‘no’ response on the diary. The reliability of the memory performance diary in the current study would have been improved by the use of informants’ reports of goal attainment and/or support for the memory impaired participant to complete the diary, as described below.

Comparison of performance on the memory performance diary between the treatment and control group was hindered by missing data as a number of subjects did not complete the memory performance diary. Poor compliance was also reflected in irregular time periods across subjects, as some participants forgot to complete the diary daily. A uniform period over which the diary was completed was further complicated by irregular occurrence of some goals, such as not having daily appointments to remember. Ideally, the baseline period should have been the same for all participants which would also have allowed assessment of the stability of baseline performance which was not conducted in the present study. Completion of the memory diary was a memory task in itself. Treatment subjects were provided with the diary at the end of the baseline session, after the third training session and with the appointment letter for their follow-up assessment. Control subjects were provided with the memory diary at the end of the baseline session, by mail six weeks later and with the appointment letter for their follow-up assessment. Compliance with completion of the memory diary may have been improved by enlisting the support of a significant other or carer to complete the daily record, such as described in the
evaluation of Neuropage (Wilson et al., 2001), the Television Assisted Prompting system (Limoncello et al., 2011), and Google calendar (McDonald et al., 2011). This would have improved not only completion of the diary but also the reliability of responses (see Roche et al., 2002). In the absence of a significant other, for those participants who lived alone, text reminders may have proved useful to prompt daily completion of the diary and delivery of the diary back the investigators. This latter task was challenging for waiting list control subjects, without the input of regular training sessions. If the memory performance diary was not returned, participants were telephoned and asked to return the information.

Alternative quantitative measures to the memory attainment diary include the use of questionnaires, such as the Canadian Occupational Performance Measure (see Hurn et al., 2006; Randall & McEwan, 2000) which has been used to evaluate the effectiveness of memory aids (Boman et al., 2007, Clare et al., 2009). In this questionnaire measure, attainment of collaboratively established goals is measured in addition to satisfaction. With a uniform format and documented reliability and validity, this measure would lend itself to future evaluation of memory aid training programs. Another attempt to capture attainment of a client’s individualised goals is goal attainment scaling which describes the degree of success of an intervention over time, with successful application in randomised controlled treatment trials (see Turner-Stokes, 2009).

### 7.3.2 Generalisation

The current study adds to the literature in terms of evidence for the effectiveness of training people with acquired memory disorders to use memory aids and improve everyday functioning. Importantly, memory impaired subjects were able to acquire skills to use memory aids and to apply these skills in day-to-day life to meet everyday memory goals. Learning was maintained across time as improvements were most evident in the treatment group at the follow-up assessment, 12 weeks after the end of training. The ultimate goal of rehabilitation is to improve everyday functioning outside of the clinic, to allow transfer of new skills into the subject’s home, work and natural environment (Sohlberg & Turkstra, 2011). The results of the current study indicate that training generalised from the outpatient clinic to the participant’s home, work and social environment.
Generalisation of training to different but similar tasks was measured with the Problem Solving Inventory. Based on work by Troyer et al., (2001; 2008; see also Kinsella et al., 2010), subjects were presented with 19 hypothetical scenarios and were required to write down what they would do in these situations, listing as many strategies or memory aids as they could think of. At follow-up, the treatment group suggested the use of a higher number of memory aids on the Problem Solving Inventory than the control group suggesting generalisation of training. There was a near significant trend for subjects in the treatment group to prescribe a greater variety of both memory aids and strategies within these hypothetical scenarios. That the effect was specific to the use of memory aids as opposed to an increase in memory strategies supports the assertion of generalisation of training in the Memory Aids Clinic. Interestingly, within the subgroup analyses, treatment subjects with a progressive neurological condition endorsed the use of more memory aids on the Problem Solving Inventory relative to progressive control subjects, a similar outcome to memory group programs for people with progressive conditions. In contrast, there were no differences on the Problem Solving Inventory between treatment and control subjects with a non-progressive condition, possibly reflecting accurate but narrow acquisition of skills within this subgroup. Progressive subjects may have acquired a more general approach to the use of memory aids from training, as demonstrated in memory group programs for people with progressive conditions (Troyer et al., 2001; 2008; Kinsella et al., 2010). The Problem Solving Inventory, developed for the current study, thus demonstrated good potential as a measure of generalisation for memory aids training. To support the use of this questionnaire in future studies, scoring by another neuropsychologist is recommended to gather information on inter-rater reliability.

The training elements that facilitated the transfer of learning from the clinic to the home/social environment included the identification and discussion of everyday memory goals, the focus upon teaching skills to compensate for everyday memory problems, provision of compliance sheets to ensure use of the memory aids between training sessions and varied opportunities to practise within sessions. The use of ‘real world’ and personal examples within the Memory Aids Clinic training may have also underpinned the transfer of training (Sohlberg & Raskin, 1996). Increased awareness
of when a memory aid may need to be applied or adapted to everyday situations may have been facilitated by steps to increase awareness of individual functioning, including the discussion of neuropsychological test results and the process of memory rehabilitation in acquired brain injury or illness. The addition of an extra session prior to training to focus on awareness has been used successfully in the training of memory notebooks with both people with acquired brain injury (Schmitter-Edgecombe et al., 1995, Fleming et al., 2005) and mild dementia (Schmitter-Edgecombe et al., 2008).

The Memory Aids Clinic was an outpatient service and was comprised of only three training sessions. To support further the transfer of training from the clinic to the participant’s home and social environment, additional training sessions are recommended in future to include a home and/or community visit. This would enable a careful match of memory aid use to the environment in which new skills are to be applied and adapted (Prigatano & Kime, 2003; Kime, 2005).

7.3.3 Outcome as measured by the neuropsychological evaluation

As neuropsychological rehabilitation studies developed, their effectiveness was traditionally measured by the use of standardised neuropsychological tests. According to the World Health Organisation’s International Classification of Functioning (WHO ICF, 2001), neuropsychological tests aim to measure functioning at the level of impairment within a particular cognitive system. The ICF framework reflected a shift in focus from the cause to the impact of a health condition. In memory rehabilitation, the important outcome shifted from an impairment focus to the impact of the impairment upon ability and limitations to participation within the context of an individual’s environment. Thus, training in the Memory Aids Clinic was not expected to transfer to the neuropsychological test results (see Geusgens et al., 2007). Neuropsychological assessment was conducted at baseline to document each participant’s strengths and weaknesses and explore whether any cognitive factors influenced outcome.

There was no effect of treatment in the Memory Aids Clinic upon neuropsychological functioning, with no interaction between time and group on tests of memory,
attention/concentration or executive functioning. Both the treatment and control group improved across time on tests of prospective memory (the Camprompt), cognitive speed (WAIS III Digit Span), auditory verbal working memory (WAIS III Letter Number sequencing), and non-verbal problem solving Brixton Spatial Anticipation test). Across time, both groups performance deteriorated on a test of visual search. Repeat assessments were conducted across a period of 18 weeks and parallel forms used where possible. Improved performance for both groups may still reflect a practice effect (Duff, 2012; Wilson et al., 2000), including the reduction of novelty. Improved performance on a test of prospective memory may reflect increased awareness of the memory supports for both the treatment and control group, an impact of training and provision of written information about memory aids.

Within participants with a non-progressive neurological condition, there was no effect of treatment on neuropsychological performance with no group-by-time interaction. Improvement for both treatment and control subjects with a non-progressive condition was evident on tests of prospective memory, cognitive speed and non-verbal problem solving. Deterioration was evident for both of these groups on measures of visual search and divided attention across time. Parallel forms of these tasks were used at baseline and at follow-up assessments. Deterioration on the test of visual search was evident across all comparisons at the group, non-progressive subjects and progressive subjects raising the question of the equivalency of these parallel forms.

Previous research has highlighted the importance of matching training techniques to the characteristics of the memory impaired individual to maximise treatment outcome. It has been suggested that people who are likely to make good use of memory aids will have mild memory impairment, will not have other cognitive impairments such as executive dysfunction, and will be under 30 years of age (Wilson & Watson, 1996; Evans et al., 2003). In the current study, no baseline neuropsychological variables predicted outcome as measured by the memory performance diary. The demographic variables of age, years of education or number of memory aids used at the time of referral did not predict outcome. Predictors were also absent for the subgroup of subjects with a non-progressive neurological condition (numbers were too small for an analysis of predictors for subjects with a progressive condition). The absence of outcome predictors is at first unexpected given the literature on long term memory aid
use. It may be that the current findings do not support the literature as the outcome of the current study and the previous studies are different, that is everyday goal attainment versus use of memory aids. However, Evans and colleagues (2003) did suggest that participants who are older, longer post-injury, with poor attention and little experience of using memory aids, will require greater support and training. It may be that the training received within the Memory Aids Clinic was sufficient to support these disadvantages to negate the impact on treatment outcome.

7.3.4 Psychosocial Outcome
The main focus of treatment in the Memory Aids Clinic was to improve everyday memory function with the systematic training of memory aids. The International Classification of Functioning (WHO 2001) hierarchy described the impact of memory impairments and disability on participation within an individual’s environment. A biopsychosocial approach to rehabilitation recognises that cognitive impairments do not occur in isolation, rather there is a complex interplay between biological, psychological and social influences on behaviour (Wilson, 2009; Williams & Evans, 2003). Therefore the current study also investigated the impact of training in the Memory Aids Clinic upon a number of psychosocial measures. Training in the use of memory aids was expected to have a positive impact on mood, self-esteem, participation and carer strain. Subjective measures of memory function were administered to determine awareness of memory problems and gauge the impact of memory problems on everyday function. Indeed, a brief questionnaire was administered to measure the impact on work, home and social functioning. Overall, the results showed minimal transfer of training to psychosocial measures of mood, self-esteem, participation or carer strain.

There was no impact of training in the Memory Aids Clinic on mood as measured by the Beck Depression Inventory with no difference between the treatment and control group across time. Clinically, both groups appeared to have benefitted from input from the Memory Aids Clinic. At baseline the treatment group were in the mild range and this had improved to the minimal range at follow-up. The control group had a similar improvement scoring in the moderate range at baseline and the mild range at follow-up. Similarly, the self-esteem of both the treatment and control participants improved on the Rosenberg Self Esteem Scale across time, with no interaction. The
non-significant change in for both groups and the change in self-esteem may reflect the positive impact of patient contact, similar to the effect on the memory diary across the baseline to end of training period. That is, the changes in self-esteem and mood may reflect the impact of the psychotherapeutic alliance between the neuropsychologist and participant, regardless of the type of treatment. Alternatively, the Rosenberg Self Esteem scale may reflect changes in general life satisfaction as opposed to the impact of increased everyday memory function (see Torrey et al., 2000).

Measurement of the psychosocial impact of rehabilitation is challenging. In the current study, changes in mood and self-esteem were expected as a consequence of improved everyday memory function. Alternatively, outcome may have been measured in terms of the impact of training in memory aids on quality of life. Quality of life has been defined by the World Health Organisation as an individual’s perception of their position in life in the context of their cultural and value systems in relation to their goals (WHO, 1998), also taking into account the interaction of an individual’s physical health, psychological state, social relationships and environment. A number of quality of life measures have been developed for people with cognitive impairment following acquired or degenerative brain injury, including measures for stroke and dementia (see von Steinbuechel et al., 2005). More recently, and after the onset of the current study, the Quality of Life after Brain Injury questionnaire (QOLIBRI; von Steinbuechel et al., 2010) was developed specifically to measure health related quality of life issues following traumatic brain injury across the domains of cognition, self, daily life, social relationships, emotion and physical problems.

With the focus on training skills to apply and adapt to everyday life, self-efficacy may have been a more appropriate construct to measure. In the progressive case series, LB and WR both reported greater confidence in their abilities after training, including their ability to return to work and study. Cicerone and colleagues (2007) found that patients’ self-efficacy for the management of cognitive symptoms made the greatest contribution to quality of life in a sample of people with traumatic brain injury. Following brain injury or the onset of a progressive neurological condition, appraisal of an event (e.g. remembering a doctor’s appointment or recounting a past holiday to
a group of friends) as stressful or threatening, harmful or placing excessive demands on resources may lead the individual to believe that they will not be able to cope with or control the event (Kendall 1996). Indeed, cognitive impairments or reduced access to premorbid resources for coping may make it difficult to adjust and cope following brain injury. Training in the Memory Aids Clinic may have increased participants’ belief in their ability to complete daily activities and attain personal goals and thus supported psychosocial adjustment post injury or diagnosis. The Cicerone study (2007) developed the Self-Efficacy Questionnaire for TBI which could have proved a useful outcome measure for the Memory Aids Clinic. Improved confidence may have contributed to the maintenance and generalisation of gains in the treatment group. The contribution of memory beliefs and self-efficacy and how this may be incorporated into the systematic training of memory aids to facilitate outcome will be discussed in detail below.

A key focus for rehabilitation interventions according to the WHO ICF framework is an individual’s participation defined as involvement in life situations at the societal level and taking into account domains for learning and applying knowledge, general tasks, communication, mobility, self-care, domestic life, interpersonal interactions, community, social and civic life (Corrigan & Bogner, 2004). Community reintegration following acquired brain injury may be the most important goal of rehabilitation (Salter et al., 2008). Improved everyday memory function, as an outcome of the Memory Aids Clinic, may be expected to impact upon a number of these participation domains. As the Community Integration Questionnaire (Willer et al., 1993) was developed to measure participation restrictions in people with cognitive impairment, it was selected to assess changes in participation in the current study. However, there was no significant treatment effect with no difference between the waiting list control group and the treatment group at follow-up. The lack of a treatment effect on participation may reflect the heterogeneous composition of the Memory Aids Clinic group as opposed to the Traumatic Brain Injury validation sample of the CIQ (see Zhang et al., 2002). The absence of change in participation may also reflect a temporal lag in the positive impact of improved memory function upon participation which was not evident across the 18-week program in the current study. For example, plans to return to work and study as described by LB and WR in
the non-progressive case series within chapter 5, would not have been captured at follow-up.

Questions have been raised about the psychometric properties of the CIQ, including sensitivity to changes over time (Dijkers, 2004). A promising alternative for future research into the impact of memory aids training on participation is the Sydney Psychosocial Reintegration Scale (Tate et al., 2004), developed to measure change in community reintegration over time of people with acquired brain injury. Assessment of resumption of social roles following the intervention may have been another means of determining any change in participation levels. The Role Resumption List (Spikman et al., 2010) assesses change in amount and quantity of activity within vocational and social domains. In the current study, participants were asked to rate subjective levels of overall memory performance and the impact of memory function on stress and within the domains of home function, social impact, and work function. There was no specific impact of training in the Memory Aids Clinic upon these measures. Both the treatment and control groups reported a reduced impact of memory problems in the domains of home, social and work functioning, again possibly reflecting the non-specific effect of interaction with the treating neuropsychologist on subjective judgements of functioning within these domains.

With improved everyday memory performance following training in the Memory Aids Clinic, increased independence and reduced reliance on others was expected. The Carer Strain Index (CSI) has previously been shown to capture reduced dependence on carers in a sample of people with ABI who had successfully used the Neuropage electronic memory aid (Teasdale et al., 2009) and was administered in the current study. However, treatment in the Memory Aids Clinic did not reduce carer strain as measured by the CSI in a comparison of treatment and control groups, nor across participants with a non-progressive or progressive neurological condition.

Participants and their significant others were administered the Prospective and Retrospective Memory Questionnaire (PRMQ) as a measure of awareness of memory difficulties. Interestingly there was no change in ratings over time for either self or other reports. This suggests that training in the Memory Aids Clinic did not impact upon subjective judgements of memory problems (either retrospective or prospective
slips) nor on the observations of others. That is, perceptions of memory problems did not objectively change, although everyday memory function with the use of memory aids did improve as measured by the memory diary. This may reflect a level of acceptance of memory problems and the need to use memory aids, even though the memory problems were on-going.

7.4 The Systematic Training of Compensatory Memory Aids.

Acquired memory impairments following brain injury and neurological disease can have a significant impact upon an individual’s everyday function, including their ability to live independently, participate in the community and return to work (Ben Yishay & Diller, 1993). Rehabilitation aims to improve the day-to-day functioning of individuals in their social environment and the most common approach to memory impairment is to compensate for difficulties as opposed to direct retraining. A compensatory memory aid is a tool or device that ‘either limits the demands on the person’s impaired ability or transforms the task or environment such that it matches the client’s abilities’ (Sohlberg, 2005, pp.51). In the current study, memory aids were classified as ‘high tech’, that is electronic assistive technology devices such as Smart Phones, pagers, voice recorders and cameras (see deJoode et al., 2010; Gillespie et al., 2012) or low technology devices such as diaries, notebooks, calendars and message boards (Kime, 2005; Sohlberg, 2005; Wilson, 2009). However, people with acquired memory disorders may find it difficult to effectively use memory aids to improve everyday functioning given the nature of their learning, memory and other cognitive deficits. In addition, it appears that individuals with memory impairments do not appear to spontaneously use electronic memory supports (Evans et al., 2003). Training in how to effectively use memory aids is required (Sohlberg, 2005; Svoboda & Richards, 2009; Elhardt et al., 2012). Other barriers to effective use of memory aids in everyday life include difficulty accessing devices or knowing which memory aid to use, beliefs about recovery of memory function after brain injury or illness, and adjustment to and/or awareness of acquired difficulties. These challenges will be discussed below in the context of the specialised training offered in the Memory Aids Clinic.
The Memory Aids Clinic adopted a systematic approach to training the use of memory aids. Training was based on Sohlberg and Mateer’s (1989) model of skill acquisition, application and adaptation which has been successfully used to teach people with brain injury to use memory note books and, more recently, smart phones (Svoboda et al., 2012). Prior to training, a task analysis of each memory aid was conducted, breaking down the use and application of each memory aid into component steps. In this way a training protocol was devised for each memory aid, including preparation of an information sheet and compliance measures to ensure the use of the memory aid between clinic sessions. The training protocol was supplemented with personally relevant examples on the basis of information gleaned from the initial interview and goal setting session. Use of the training protocols to train the use of memory aids was illustrated by the case series in chapters five and six. Examples of training protocols can be seen in Appendix 4.

Training of each memory aid to meet targeted everyday behaviours began with direct instruction as the Neuropsychologist modelled correct use of the aid; followed by the application of error reduction principles to ensure mastery of skills; and the opportunity for extended practice trials within training sessions. Training in additional memory aids to meet the individual’s everyday memory goal was not attempted until mastery was demonstrated in the initial memory aid. The Memory Aids Clinic contained three training sessions. Additional training sessions may have allowed for deeper consolidation of skills (see Elhardt et al., 2008), notably for participants with a progressive condition. Homework was given at the end of each session, typically in the form of a compliance measure (see Appendix 4). For example, participants were required to make note of when they referred to their message board, applied goal review strategies to their memory aids or were adherent with their medication regime. Homework aimed to facilitate application of skills acquired within the clinic setting to the participant’s environment and thus improve generalisation of learning. Maintenance of skills across the training period was also supported by homework and compliance measures by ensuring that the memory aid was used consistently. Another key feature of training in the Memory Aids Clinic was the presentation of probes at the beginning of subsequent training sessions (see Elhardt et al., 2012; Sohlberg & Turkstra, 2011). Knowledge of the essential training elements presented at the initial session was questioned to determine the retention of new learning. This allowed for
additional modelling and practice of skills that were vulnerable and require additional consolidation (Elhardt et al., 2012).

Training aimed to support the use of a specific memory aid to meet an everyday memory goal. This was achieved under error reduction conditions, as participants were instructed to not guess if they did not know how to use the memory aid or the answer to a question about the application of a memory aid in everyday life. It may be that the memory aids training process entailed sufficient effort to support flexible learning and generalisation of skills to another environment (e.g. home) and other memory problems as suggested by changes on the Problem Solving Inventory at follow-up. Training on multiple and personal examples would have also supported flexible learning (Stark et al., 2005). Training was adapted according to the individual’s needs with the use of techniques such as expanded spaced rehearsal to teach specific skills (such as the button to press on a talking watch or how to use a key finder).

Another important element of training in the Memory Aids Clinic was the process of collaborative goal setting and careful planning of the intervention on the basis of information collected at the baseline sessions (interview and assessment) This approach is reflected in Sohlberg and Turkstra’s (2011) systematic training model which included an initial planning stage to identify key learner characteristics, to define the treatment target, specify the desired outcome and design the treatment intervention. At the initial training session of the Memory Aids Clinic, aids were selected on the basis of the participant’s goal, on the basis of the Neuropsychologist’s knowledge of available support and the participant’s individual preferences. Physical and sensory limitations were also considered when selected memory aids, for example a medication box may have been suggested on the basis of the ease of opening lids for an individual with dyspraxia. Thus the planning and careful selection of memory aids in the current study addressed the need for matching the memory aid to the client’s needs (Gilette & DePompei, 2004) and their individual characteristics (Scherer et al., 2005).

The relatively unique memory aids clinic structure might have underpinned successful generalisation and maintenance from the clinic to the participant’s environment, as
reflected in attainment of everyday memory goals. Training was conducted within a library of memory aids. Participants were able to select their preferred memory aid, under the guidance of the treating Neuropsychologist. This was the memory aid that the participant was trained to use and the device that the participant used at home. The provision of actual memory aids by the Memory Aids Clinic overcame the potential barrier of access to memory aids and problems with self-funding to purchase aids. Provision of memory aids may also have supported long term use by allowing immediate use of the device following training and active involvement in selection of the memory aid may have promoted greater user involvement in the training process (Wessels et al., 2003). The establishment of the memory aids library meant that the treating neuropsychologist had to be familiar with and confident in the use of memory aids, including electronic devices, a challenge previously identified in the literature (O’Neill-Pirozzi et al., 2004)

Awareness of memory impairments and the impact of these changes in everyday life was a challenge to successful training. Awareness has been conceptualised in terms of intellectual awareness of changes to memory function; emergent awareness of a problem as it is actually occurring; and anticipatory awareness that a problem is going to occur because of a memory deficit (Crosson et al., 1989). Training within the memory aids clinic addressed awareness across these levels. A measure of awareness can be derived from the discrepancy between self and other ratings on the Prospective and Retrospective Memory Questionnaire. There was no significant change in the proportion of subjects with a discrepancy between self and other ratings across time on measures of prospective, retrospective or total measures of everyday memory function in the current sample. Development of awareness was facilitated by collaborative goal setting and discussion of everyday problems at the initial interview and completion of the memory performance diary. All participants were provided with verbal and written feedback about their assessment results at the initial training session to further raise awareness of memory and cognitive deficits. Incorporation of everyday examples into the training protocol, homework tasks and use of compliance may have supported emergent awareness. Reality testing may have further supported awareness of memory impairments as incorporated in notebook training (Fleming et al., 2005; Schmitter-Edgecombe et al., 1995). Memory Aids Clinic participants could have been asked to rate their expected performance on homework tasks and
completion of compliance assessments with discussion of any discrepancy at the following session. Only three training sessions were provided in the current study. In future, systematic training in the use of memory aids could incorporate an additional session in anticipation of when memory problems may occur across different contexts as suggested by Ownsworth & McFarland, (1999).

It has been argued that the force behind change in rehabilitation is the client’s motivational engagement, such that the client needs to be ready to adopt strategies, such as memory aids, for the rehabilitation program to be effective (Van Den Broek, 2005; Kime, 2006). A participant may need to be prepared for rehabilitation by facilitating motivational engagement and concern regarding their memory difficulties; to work through potential emotional barriers to the use of memory compensations (Baldwin et al., 2011). These barriers include acknowledgement of the memory problems as noted above but also beliefs about change, such as the use of a memory aid as a hindrance to recovery (Wilson & Watson, 1996) or the stigma associated with using a memory support (Baldwin et al., 2011). Participants attended the baseline session in the Memory Aids Clinic with various degrees of understanding of the rehabilitation process and readiness to change; yet the challenge was to bring about a positive treatment outcome in only three training sessions. Indeed, of the 75 participants in the treatment group who attended the baseline assessment 12 did not complete the rehabilitation program. Five of these participants refused the offer of treatment, which may have reflected poor awareness of their problems, and five were non-compliant with treatment, such as failure to attend appointments even with appropriate support (e.g. letters and reminders). The remaining two subjects were unable to complete the program due to unforeseen closure of the clinic.

Engagement in the Memory Aids Clinic program was facilitated by collaborative goal setting and the provision of memory aids. All participants were provided with feedback about their assessment results and the process of recovery and rehabilitation following acquired brain injury was discussed. A more robust treatment effect might have been facilitated by incorporation of additional ‘pre-treatment’ sessions to enhance motivation and engagement prior to skills acquisition training. Motivational interviewing is a therapeutic approach that aims to enhance intrinsic motivation to change by exploring and resolving ambivalence and it has been increasingly applied
to brain injury rehabilitation (Medley & Powell, 2010; Hsieh et al., 2012). A pre-
treatment session in the Memory Aids Clinic may have adopted a motivational
interviewing approach to enhance the participants’ readiness for treatment by
mediating self-awareness and increasing commitment to therapy goals.

The results of the current study suggest that systematic training in compensatory
memory aids helps people with acquired non-progressive memory disorders to attain
everyday memory goals. A limitation of the current study is that it does not identify
which are the essential components of the training program that support a positive
outcome. The case series presentation aimed to illustrate in more detail the content of
the training program. Future studies could explore the intensity of training through
comparison of training programs of different lengths. In a review of studies
instructing memory impaired individuals, Elhardt and colleagues (2008) suggested a
minimum of six training sessions with memory. This suggested treatment dose could
be compared with the three sessions of the current study or a higher number of
sessions, such as the training to criteria used by Svoboda and Richards (2009). It is
important to identify the optimum number of training sessions required if such a
program is to be economically viable within a health service that is challenged for
resources. As noted, future investigations could also examine the added value of
sessions to target awareness, beliefs about using memory aids, and readiness for
engagement in rehabilitation. Finally, the results of the current study indicate that 12
weeks after the end of training treatment subjects continued to use memory aids to
support everyday memory goals. Ideally, follow-up would have also been conducted
across a longer time period to determine whether devices had been abandoned with
time. The case of IB is useful in this respect as it indicated variable maintenance
across a longer period of time in a subject with a progressive neurological condition.

7.5 Memory Aids and Progressive Memory Disorders
The participants of the current study presented with a variety of neuropsychiatric
disorders, reflecting the heterogeneity common to memory rehabilitation research
(Mateer, 2009). Of note, the group study included subjects with either a progressive or
a non-progressive neurological condition. Analysis at the group level indicated a
difference between the treatment and control participants only at follow-up whereas
individual analysis revealed differences at the both the end of training and follow-up.
A subgroup analysis was thus conducted to examine performance on the basis of the progressive or non-progressive nature of the participants’ neurological condition.

Comparison of treatment subjects with a non-progressive condition to their respective non-progressive controls indicated a significant effect of treatment with higher goal attainment at the end of training, which was maintained at follow-up. There were no significant difference between treatment or subjects with a progressive condition and controls with a progressive condition. Numbers were small in these latter comparisons. In a novel investigation, direct comparison of participants in the treatment group with a non-progressive condition to those with a progressive condition highlighted the advantage for training in the Memory Aids Clinic for people with a non-progressive condition. Treatment subjects with a non-progressive condition had significantly higher everyday memory goal attainment than those with a progressive condition at the end of training and at follow-up. This finding suggests that subjects with a progressive neurological disorder did not benefit from the systematic training offered within the Memory Aids Clinic as much.

This null result, suggesting that participants with a progressive neurological disorder do not benefit from the systematic training of memory aids in contrast with recent reports in the literature. Whilst the application of neurorehabilitation techniques traditionally used in brain injury to people with dementia is a new field, it is a growing field of investigation. Goal directed cognitive rehabilitation, including the use of memory aids, improved everyday task performance for a group of people with early AD (Clare et al., 2010) and in a single case of a woman with MCI (Clare et al., 2009). Sohlberg and Mateer’s acquisition, application and adaptation program has been adapted to teach the use of memory notebooks to compensate for everyday memory problems in people with dementia (Greenaway et al., 2008; Quittre et al., 2005) and Mild Cognitive Impairment (Greenaway et al., 2012). Schmitter-Edgecombe and colleagues (2008) added an anticipation phase to the three stage program to support people with very mild dementia in their use of memory notebooks. Of note, training relied more on the use of error reduction techniques, such as vanishing cues and support from carers (Schmitter-Edgecombe et al., 2008). Maintenance of treatment gains was vulnerable. High technology memory aids have
also been adopted by people with MCI or early dementia, although these studies have typically described single cases (Oriani et al., 2003; Duff & Dolphin, 2007).

The lack of positive treatment outcome for participants with a progressive neurological condition may reflect the different neuropsychological profile of the progressive and non-progressive group. Participants with a progressive condition had poorer executive functioning and prospective memory function compared to participants with a non-progressive condition. As a result progressive participants may have required greater treatment structure to compensate for poor planning and concept formation to allow them to benefit from training. With a poorer prospective memory on formal measures at baseline, subjects in the progressive group may not have been equally matched with the non-progressive group in terms of everyday memory function. Therefore, the current results argue for a greater intensity of training for people with progressive conditions. More sessions could have allowed for strengthening of new learning by providing greater opportunities for practice (Elhardt et al., 2012), greater support at the time of initial acquisition with the use of vanishing cues (Bourgeois et al., 2003; Clare, 2008) and involvement of significant others as co-therapists (Schmitter-Edgecombe et al., 2008; Clare et al., 2010). The use of booster sessions to maintain treatments effects (Greenaway et al., 2012) may be more pertinent in this user group given the progressive nature of the neurological conditions. Group cognitive rehabilitation, including training of memory aids, may be worth exploring for people with progressive neurological conditions (see Troyer et al., 2001; Kinsella et al., 2009). With greater executive impairment in progressive group, this format may possibly facilitate greater conceptual understanding of the application of memory aids in everyday life.

Therefore, from the current results, it is premature to conclude that systematic training in memory aids is not beneficial for people with progressive neurological conditions. More sessions may be required, with a need to support greater conceptual understanding, stronger skills acquisition and greater opportunity for practice in this group with greater memory and executive impairment. In addition, the number of subjects available for comparison with the non-progressive group was small and heterogeneous. With a higher number of participants, the effectiveness of training of
memory aids for people with MCI and for mild dementia could be examined in a future study.

7.6 Conclusion:
The current study aimed to adopt a systematic approach in the training of memory aids to meet everyday functional goals for people with acquired neurological conditions. Training was developed on the basis of Sohlberg and Mateer’s (1989) model of skill acquisition, application and adaptation which was initially developed to train memory notebooks following traumatic brain injury. This training model was more recently extended to include a pre-treatment planning stage (Sohlberg & Turkstra, 2011). Although the current study was implemented prior to this revision, treatment planning and analysis of each memory aid echoes the Plan, Implement and Evaluate model suggested by these authors. The key elements of the Memory Aids Clinic can be summarised as collaborative goal setting, task analysis of how to use and apply each memory aid, modelling of behaviour and use of error reduction techniques, opportunities for extended practice, including compliance measures between sessions, and probes to determine retention of previously learnt information.

The results indicated that systematic training in memory aids within a three session outpatient rehabilitation program supported attainment and maintenance of everyday goals. This treatment effect was evident at follow-up, with no significant difference between the treatment and control group immediately after training. There was evidence of generalisation of training as the treatment group were able to suggest greater use of compensatory memory aids across diverse hypothetical scenarios on the Problem Solving Inventory. A particular strength of the current study is the large sample size which is in contrast to the small samples or case series presented in the literature, with the exception of the Neuropage studies (Wilson et al., 1997, 2003). In addition, the current sample was a heterogenous group without highly restrictive exclusion or inclusion criteria, typical of an outpatient memory clinic. Thus, treatment model can be translated into a clinical setting such as an outpatient National Health Service clinic.

Treatment did not impact upon psychosocial measures, including mood, self-esteem, participation or carer strain, or have any effect on formal neuropsychological
measures. Subgroup analysis indicated that for this clinical sample, participants with a non-progressive neurological condition benefitted from training. Participants with a progressive neurological condition did not benefit from a three session program in the training of memory aids. The comparison between participants with a non-progressive and those with a progressive neurological condition is another unique contribution of the current study.

There is a wealth of literature on the effectiveness of memory aids in supporting the everyday function in acquired brain injury and neurological conditions (Sohlberg, 2006). There is a need to describe how to train individuals with cognitive and memory impairments to effectively use memory aids. Given the rapid proliferation of assistive technology devices in addition to the wide range of low technology supports, it is not practical to investigate the effectiveness of each memory aid. Gillespie and colleagues (2012) have conceptualised high technology memory aids in terms of cognitive functions e.g. alerting, reminding, storage, which helps to generalise results from specific memory aids studies toward cognitive functions as defined by the International Classification of Functioning. This conceptualisation can be used to select appropriate and effective memory aids to meet everyday memory goals developed in terms of participants’ everyday function and participation in keeping with the WHO International Classification of Functioning (2001). The training program developed and now evaluated within the Memory Aids Clinic provides a platform to allow people with acquired memory impairments to use these memory aids effectively to meet every-day functional goals.
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Appendices

1. Outcome measures
2. Information and consent form
3. Baseline measures
4. Training protocols
5. Neuropsychology test summaries for non-progressive case series
6. Neuropsychology test summaries for progressive case series
Appendix 1: Outcome measures

Memory Performance diary

Record memory performance *(yes or no)* at the end of each day or soon after event has occurred.

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Subjective memory questionnaire

NAME:
DATE:

We would like to see how much you have been affected by everyday memory difficulties – e.g. remembering messages, remembering to do things, etc.

1. How bad would you say your memory difficulties are?
I……………………………………………………………………………………………l
0 1 2 3 4 5 6 7 8 9 10
Minor Quite Bad Very Bad

2. How much stress do your memory difficulties cause you?
I……………………………………………………………………………………………l
0 1 2 3 4 5 6 7 8 9 10
No stress Some stress A lot of stress

3. How do your memory difficulties affect your ability to cope at home?
I……………………………………………………………………………………………l
0 1 2 3 4 5 6 7 8 9 10
Not at all To some degree A lot

4. How do your memory difficulties affect your ability to cope in social settings?
I……………………………………………………………………………………………l
0 1 2 3 4 5 6 7 8 9 10
Not at all To some degree A lot

5. [If you are working] How do your memory difficulties affect your ability to cope at work?
I……………………………………………………………………………………………l
0 1 2 3 4 5 6 7 8 9 10
Not at all To some degree A lot
Problem Solving Inventory

1. You can’t find where you have put your diary. How do you ensure that you can always find your diary when you need it?

1. How do you remember to take your medication at the right time each day?

2. You are at work and someone telephoned for one of your colleagues. How do you remember to pass this phone message along?

3. You have to phone the doctor at 4pm. How do you remember to do this?

4. You left your wallet at home when going out. How do you remember to take it with you next time you leave home?

5. You need to buy some milk. How do you remember to do this?

6. You always have to go back and check that you have done something that you were meant to do. What can you do to keep track of what you have to do?

7. You phone the Train Line to find the details and times for a journey to Bath. How do you remember all of the information that is given to you over the phone?

8. At each session, the Neuropsychologist gives you homework to do. How do you remember to do your homework for the next Memory Aids Clinic session?

9. You have to pay a bill by next Tuesday. How do you remember to pay the bill?

10. You had a number of things to do but became distracted and did not finish all that you had to. How do you avoid this problem in the future?

11. You planned to have lunch with a friend the following week. However, when the time came you completely forgot the arrangement. What can you do to remember future appointments?
12. It is hard to remember what you did last week. What can you do to remember past events?

13. You want to watch an interesting TV program on Thursday night. How do you remember to do this?

14. You have a doctor’s appointment at the end of the month. However, you need to change this appointment and make another one. How to you remember to both make this change and to also keep the new appointment?

15. It is your mother’s birthday next week and you need to send her a birthday card. How to you remember to do this?

16. You borrowed a DVD from a friend. How to you remember to return it the next day?

17. You are asked to bring a list of medications with you to your next hospital appointment. How do you remember to compile the list and bring it with you?

18. You met a number of new people at a party on the weekend. How do you remember their details?
Appendix 2: Information and consent form
A MEMORY AIDS CLINIC FOR THE MANAGEMENT OF EVERYDAY MEMORY PROBLEMS

Background:
Memory problems are commonly reported following acquired brain injury arising from causes such as traumatic brain injury, stroke, or epilepsy. People also report everyday memory difficulties in dementia and during periods of low mood. Such memory problems can make it difficult for a person to live independently, participate in the community and return to or maintain their desired level of functioning.

Memory aids are devices or equipment that can compensate for everyday memory difficulties. Examples include diaries, post it notes, timers, mobile phones and message boards. Effective use of memory aids may help a person to manage their memory problems in everyday life. Whilst there is a growing body of evidence in support of the use of memory aids, we are interested in finding out whether memory aid use is effective when trained in a systematic way.

What does the study involve?
You have been referred to the Memory Aids Clinic as the doctor in charge of your care feels that you may benefit from the use of memory aids to manage your everyday memory problems.

First of all, the study involves undertaking a range of neuropsychological (memory) tests and questionnaires to measure your current memory function and mood. The tests will be repeated to monitor any changes in your memory function. We will also set some specific and personal goals for you to work on in the treatment sessions. For example, you may want to remember to take your medication on time or to attend appointments.

At a later stage, treatment sessions will aim to match various memory aids to meet these everyday goals. Together we will spend time learning how to use a number of memory aids and how to make memory aids use part of your everyday life.

What will happen with the results?
You will be provided with written feedback about your test results and progress. When your treatment is completed, a report will also be sent to the doctor who referred you to the clinic. We hope to publish the final outcome of the Memory Aids Clinic in scientific journals as this will help to advance the knowledge base of memory rehabilitation. The outcome data may also be used to argue for additional memory services with the NHS. In both instances, your results will be but one of a large group and any identifying information will be removed.
Should we wish to document your individual treatment, we will contact you for permission and again identifying information will be removed.
MEMORY AIDS CLINIC

Ms. Bonnie-Kate Dewar  BSc MSc
Research Clinical Neuropsychologist
Chartered Psychologist

Professor M D Kopelman PhD FBPsS FRCPsych
Professor of Neuropsychiatry
Consultant Neuropsychiatrist
Chartered Psychologist

A MEMORY AIDS CLINIC FOR THE MANAGEMENT OF EVERYDAY MEMORY PROBLEMS

CONSENT FORM

Please tick the box if you agree with the following statements:

I agree to take part in the study which aims to evaluate “A memory aids clinic for the management of everyday memory problems”.

I understand that the information I provide is confidential and will be kept in a secure location.

I am happy for the outcome data to be used for research purposes, on the understanding that any identifying information will be removed.

I understand that I can withdraw from the Memory Aids Clinic treatment at any time without any adverse effect on other treatment I may be having.
Appendix 3: Clinical Forms

Memory Diary

Every evening over the next 7 days, go through the diary with your partner/friend and indicate against each question, how many times it happened to you during that day.

If it occurred once, put 1 in that square
If it occurred twice, put 2 in that square
If it occurred three times, put 3 in that square, and so on.
If it did not apply to you during the day put 0.

Try to complete the diary regularly for a week.
Always do it with your partner or a close friend if possible. If you forget to fill it in one evening don't guess. Just leave that day blank and carry on until you have completed each column.

Please bring this with you to our next meeting on ________________.

<table>
<thead>
<tr>
<th>Please enter day of week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
</tr>
<tr>
<td>Day 2</td>
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<tr>
<td>Day 3</td>
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<tr>
<td>Day 4</td>
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<tr>
<td>Day 5</td>
</tr>
<tr>
<td>Day 6</td>
</tr>
<tr>
<td>Day 7</td>
</tr>
</tbody>
</table>
1. Forgetting where you have put something. Losing things around the house.
2. Failing to recognise a place that you are told you have often been to before.
3. Finding a television story difficult to follow.
4. Not remembering a change in your daily routine, such as a change in the place where something is kept, or a change in the time something happens. Following your old routine by mistake.
5. Having to go back to check whether you have done something that you meant to do.
6. When thinking of the past, forgetting when something happened. For example, whether it was yesterday or last week.
7. Completely forgetting to take things with you, or leaving things behind and having to go back and fetch them.
8. Forgetting that you were told something yesterday or a few days ago, and having to be reminded of it.
9. Starting to read something (a book or an article in a newspaper or magazine) without realising you have already read it.
10. Failing to recognise, by sight, close relatives or friends that you meet frequently.

11. Having difficulty in picking up a new skill. For example, having difficulty in learning a new game or in working some new gadget after you have practised once or twice.

12. Finding that a word is "on the tip of your tongue". You know what it is but you can't find it.

13. Completely forgetting to do things you said you would do, and things you planned to do.

14. Forgetting important details of what you did or what happened to you the day before.

15. When talking to someone, forgetting what you have just said. Maybe saying "What was I talking about?"

16. When reading a newspaper or magazine being unable to follow the thread of a story, losing track of what it is about.

17. Forgetting to tell somebody something important. Perhaps forgetting to pass on a message or remind someone of something.

18. Forgetting important details about yourself, e.g. your birthdate, or where you live.

19. Getting the details of what someone has told you mixed up or confused.
20. Telling someone a story or joke that you have told them once already.

21. Forgetting details of things you do regularly. Details of what to do, or at what time to do it.

22. Finding that the faces of famous people seen on television or in photographs, look unfamiliar.

23. Forgetting where things are normally kept or looking for them in the wrong place.

24a. Getting lost or turning in the wrong direction on a journey, a walk, or in a building, where you have OFTEN been before.

24b. Getting lost or turning in the wrong direction on a journey, a walk, or in a building, where you have been only ONCE or TWICE before.

25. Doing some routine thing twice by mistake. For example, putting two lots of tea in the teapot, or going to brush/comb your hair when you have just done so.

26. Repeating to someone what you have just told them, or asking them the same question twice.

27. Having to be nagged before you would do something.

28. Remembering to do something, but not at the right time.
29. What things did you forget to do today that you wanted to do?

Day 1: ____________________________________________

Day 2: ____________________________________________

Day 3: ____________________________________________

Day 4: ____________________________________________

Day 5: ____________________________________________

Day 6: ____________________________________________

Day 7: ____________________________________________

30. Any other memory or concentration difficulties? If so, please describe.

Day 1: ____________________________________________

Day 2: ____________________________________________

Day 3: ____________________________________________

Day 4: ____________________________________________
Day 5: 

Day 6: 

Day 7: 

279
Session summary:

Date:

<table>
<thead>
<tr>
<th>Discussed in today’s session and memory aids given:</th>
<th>Client to do:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Neuropsychologist to do before next session:</th>
<th>Next appointment:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Content of next appointment:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
Appendix 4: Training protocols for memory aids

Whiteboard training protocol:

Training in use of a whiteboard has five main components:
1. Knowledge of the use of and components of the NOBO mat
2. How to use it
3. Examples to practise using the NOBO mat in session
4. Homework exercises
5. An information sheet

1. USE AND COMPONENTS
   - Used as a message pad
   - To remind you of something
   - To write a temporary note that you can later move into somewhere permanent.
   - Can act as a weekly diary.
   - To make it useful, the whiteboard can be divided up into headings. For example:
     To do List-today
     To Do list-long term
     ASAP
     Appointments
     Messages
     Date, day

What is a NOBO mat made up of?
   - Pens
   - Erasers
   - Tape
   - Magnets or Tack Dots
   Also
   - Post it notes
   - Day/date clock
   - Push button alarm

How do I refer to the NOBO mat?
   - Alarm- learning to use a push button alarm
   - Routine- get into the habit of checking the board at set times during the day
   - Location- attach the whiteboard in a place I spend a lot of time in.
   - Location- attach the whiteboard in a place where I keep my memory notes e.g. kitchen, near the phone.

2. HOW TO USE IT
   - Check the whiteboard and the beginning of each day. Update information such as date, day. Clear old messages.
   - Write a list of things that you need to do. Cross off or wipe off each task as it is completed.
   - If using NOBO mat as a weekly diary, get into the routine of writing weekly update on a set day e.g. every Sunday night.
• Check the information at set times during the day e.g. alarm?, when I ask my carer a question, at routine times (e.g. breakfast, lunch, dinner).
• Write information immediately e.g. after a phone message, when the appointments come in the mail.
• Cross off tasks when completed. Erase at the beginning of each day during the update of the whiteboard.
• Add extra notes with the use of Post It Notes. Transfer these temporary messages to my diary/organiser.
• Stick bills, appointments on to the board with magnets or Tack Dots.
• Making notes: WHO, WHEN WHERE AND WHAT?

3. IN SESSION EXAMPLES
• I have given you some homework to do for your next memory clinic appointment. How can you use the whiteboard to remind you to do the homework?
• A friend has phoned a left a message on your answer phone. How can you use the whiteboard to remember to return their call?
• Use this example again, but call from another room and have patient take the message, transferring it onto the whiteboard.
• Here is your next appointment letter for the memory aids clinic. Where would you put it on the NOBO mat?
• You need to go shopping tomorrow afternoon. How can you use the whiteboard to remind you of this task?
• You have run out of coffee. How can you use the whiteboard to remember to buy some more?

• Using timer to refer to whiteboard- set alarm. When it goes off, tell me…
  What appointments are coming up?
  What do you have to do today ASAP?
  Has anyone left you any messages?
  What is on your to do list- long term?
  Do you have to do any shopping?
  What is the date today?

4. HOMEWORK EXERCISES
• Set up whiteboard
• Review and update board this Sunday evening.

5. INFORMATION SHEET
Session 1:

Direct instruction of use and components

Test this knowledge with NK’s question sheet
1. What is it used for? (reminder, message pad, to do list, temporary store of information).
2. What category headings can you use?
3. What do you need to use a whiteboard?
4. Where is it located?
5. What is it attached to?
6. When do I check the whiteboard? (routine, set day, morning, alarm).
7. When do I write information on the NOBO mat? (immediately)
8. When do I cross information off the NOBO mat? (when I have finished the task).
9. What else can I attach to the whiteboard? (Post It notes, Tack Dots)
10. How do I know when I have finished a task?

** Set up personalised whiteboard based on goals.

Homework:
Attach whiteboard to designated home memory centre.
Take photograph of new whiteboard for next session.

Metacognitive: Prediction of performance on homework task.
- Do you think it will be difficult to set up the whiteboard?
- Do you think the white board will be hard to use? (goal? Of checking whiteboard at set times?)
- Will you be able to complete the homework?
### Training components and use of whiteboard:

<table>
<thead>
<tr>
<th>Demonstration</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What is it used for?</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reminder</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temp note</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekly diary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Where is it located in your house?</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kitchen</td>
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<tr>
<td><strong>When do I check the board?</strong></td>
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<tr>
<td>Regularly, B/L/D</td>
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<tr>
<td><strong>When do I make notes?</strong></td>
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<tr>
<td>Immediately</td>
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<tr>
<td><strong>When do I cross off notes?</strong></td>
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<tr>
<td>When completed</td>
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<td></td>
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<tr>
<td><strong>When do I review?</strong></td>
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<tr>
<td>Start of day</td>
<td></td>
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<td></td>
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<tr>
<td><strong>At start of day</strong></td>
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<tr>
<td>I….</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Make to do list</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clear old tasks</td>
<td></td>
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<tr>
<td><strong>How do I know I have finished a task?</strong></td>
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<tr>
<td>It is crossed off</td>
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<td></td>
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<tr>
<td><strong>How can I add extra notes?</strong></td>
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<tr>
<td>Post it notes magnets</td>
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</tr>
</tbody>
</table>
Session 2:

**Review use of NOBO Mat.**

- Knowledge of components
- Completion of homework - compare with prediction of performance
- Any difficulties?
- Review record of use

**Training: Learning to reference the whiteboard. (Kime, 2006)**

Train association of alarm with the act of referring to the whiteboard to check daily activities and messages.

In session: (after training use of alarm - see NK’s document)

Training- “When alarm sounds, check whiteboard”

- **Demonstrate action** - alarm sounds NP checks the NOBO mat
- **Vanishing cues:**
  - When alarm sounds, check whiteboard
  - When alarm sounds, check ?
  - When alarm sounds, ? ?
  - When ?, ?, ? ?
  - ? ?, ?, ? ?

- **Expanded rehearsal:**
  - One minute
  - Two minutes
  - Five minutes
  - Ten minutes

  Fill the break with conversation. If client forgets the association with the alarm, direct them to the NOBO mat.

  Can follow expanded rehearsal by extending the time period that the client is able to refer to the whiteboard and make an entry/check information correctly without any prompts.

Use of an alarm is good for people who need to check the whiteboard hourly. This could also be an alarm on a digital watch.

Alternatively, the subject can check the whiteboard at set times of the day, co-inciding with their routine. For example, checking the whiteboard at breakfast and at bedtime, or upon arrival at work, after lunch etc.

Support network: When the alarm goes off, ask the client what they have to do. If they do not know, don’t guess. Rather tell them- exactly and immediately- “When alarm sounds, check whiteboard”.

If client asks a question regarding activity, appointment, person, personal information etc. refer them to the whiteboard. Do not ask them to guess. Tell them specifically to look at the whiteboard and physically do it with them. This will be a form of practise.
During the learning phase it is important the carer/family member physically direct the client to the whiteboard, checking it is correctly used, entering and retrieving information.

**Training: Reviewing the whiteboard**
Will there be a regular review of the contents of the whiteboard? If so, decide when this will be done and how. For example, it could be reviewed every Sunday evening or at the beginning of the day. The subject may need assistance to review the whiteboard and remove completed tasks or old appointments.

**Homework**
: take a photograph of the whiteboard before and after review period.
: complete record form noting when the whiteboard is checked morning, midday and evening or with use of alarm.
: ask for prediction of performance
When alarm sounds, check whiteboard

When alarm sounds, check ?

When alarm sounds, ? ?

When alarm ?, ? ?

When ?, ? ?

? ? ?, ? ?
Session 3:

Completion of homework- compare with prediction of performance. Were there any difficulties?

Review use of whiteboard- knowledge of components and how to use it. Review use of alarm and referencing the whiteboard

Training: Repeat training of alarm as necessary
WHITEBOARDS
WHAT ARE WHITEBOARDS?

- **WHITEBOARDS** are convenient and easy to use message pads.
- Attach the **WHITEBOARD** to something that you pass by frequently.
- **WHITEBOARDS** can be used to remind you to something.
- They can also be used to write a note that you later write again into something more permanent.
- You can divide the mat into sections for the different types of things you need to remember.
- You could use different coloured pens for different types of reminders.
- Write in CAPITAL letters - these stand out better.
- You can use an alarm to help you get into the habit of looking at the **WHITEBOARD** regularly.
HOW CAN A WHITEBOARD BE USEFUL?

You can divide the **WHITEBOARD** into separate sections for different types of things you need to remember. These may include: -

- Things to do and events that are happening in the future.
- Things you need to buy.
- Things you need to take with you when you go out or when you go on holiday.
- Messages for other people.
- Phone calls to make.

A typical **WHITEBOARD** could look like this -

<table>
<thead>
<tr>
<th>TO DO SOON</th>
<th><strong>REMINDERS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>APPOINTMENTS</th>
<th>MESSAGES</th>
</tr>
</thead>
</table>
Tick the box when you checked the whiteboard at the following times…

<table>
<thead>
<tr>
<th>MONDAY</th>
<th>TUESDAY</th>
<th>WEDNESDAY</th>
<th>THURSDAY</th>
<th>FRIDAY</th>
<th>SATURDAY</th>
<th>SUNDAY</th>
</tr>
</thead>
<tbody>
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</tr>
</tbody>
</table>

On that day, did you check the whiteboard more often than these times? YES/NO
Filofax training protocol

Session 1:

Part A. Introduce the sections of the organiser.
Train knowledge of what these sections are and what they are used for. Need to ensure that the client has a clear understanding of how the book is set up.

Part B. Train how to use the different sections of the diary.

Daily Diary

Retrieving information:
Find today with the page marker.
Check that it is on the correct page.
Take time to check what I have to do today.
When task is completed, cross it off immediately.

CNN (Donaghy & Williams, 1998)
1. Check your watch for the correct date & time
2. Open your journal to the correct day of the week
3. Cross off the completed task
4. (Make a notation on the log sheet about the completed task just crossed off)
5. Check what the next task is

Entering new appointments:
Enter information as soon as it is received.
Enter information on date that activity will take place.
Notes to include time, place, and topic.

** If low level of activity and using the alarm- when the alarm goes off, make a note of what you were doing at each hour. Check the time and date. Then concise notes containing the 4 W’s/what they are doing.

** Demonstrate use of daily diary to their support network.

Practise- entering in current event (e.g. current appointment)
Practise- entering event in the next week (e.g. next appointment)

Note the level of cueing required to reference diary for practise exercises/homework
None
Minimal: “I’ll bet you want to remember this later”
Moderate: “What should you do to remember this?”
Note level of cueing required for each entry.

To Do List
For tasks that do not have to be completed on a particular day or at a particular time. Support network may have to initially cue client to include items on the To Do List as appropriate and to refer to it daily. May need a reminder note on the Daily Diary page to refer to the To Do List. Date of entry, details of task, date completed or transferred to daily diary. Cross off when completed or transferred.

*Practise- enter some tasks to do during the week with client and support network. Or mock phone call from NP from another room, asking client to do something I the future.*

Does this client need any **forms** developed to be placed in their organiser? E.g. how to use the alarm?

Does this client need any checklists developed e.g. household chores, work tasks? This checklist could then be included in the organiser.

**Homework:**
To complete personal information section.
To bring something to the next session.
To make a phone call to NP’s voice mail or send an email to NP at a set time. Estimation of homework performance.

**Personal Information**
To be commenced in presence of NP and support network when give the organiser, with remaining information completed as homework.

If Orientation questions arise (e.g. repetitive questioning) prompted to refer to their organiser. The client can then read through their personal details with support network progressing to more independent use. Rather than asking the client to guess, they will need consistent prompts to refer to the information in the organiser so no errors are made.

*Practise- ask questions about partner’s birthday/mother’s birthday for example. *Practise- ask questions about their address or GP surgery*

**Address Section**
Test knowledge of use.
*Practise- entering NP details.*
<table>
<thead>
<tr>
<th>Demonstration</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where is it located?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kitchen</td>
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<tr>
<td>Carry it always</td>
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</tr>
<tr>
<td>When do I check the Filofax?</td>
<td></td>
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</tr>
<tr>
<td>Regularly</td>
<td></td>
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</tr>
<tr>
<td>Alarm?</td>
<td></td>
<td></td>
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<tr>
<td>Use of daily diary section?</td>
<td></td>
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<tr>
<td>Reminder</td>
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<tr>
<td>Temp note</td>
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<td></td>
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<tr>
<td>Weekly diary</td>
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<td></td>
</tr>
<tr>
<td>When do I review?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start of day</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Use of To do list?</td>
<td></td>
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<tr>
<td>At start of day</td>
<td></td>
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<tr>
<td>I….</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Make to do list</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clear old tasks</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>When do I make notes?</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Immediately</td>
<td></td>
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<tr>
<td>How do I make notes?</td>
<td></td>
<td></td>
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<tr>
<td>How do I know I have finished a task?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It is crossed off</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of extra pages?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note instructions</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Session 2:
Review Homework- compare to estimation of performance.

Review use of DAILY DIARY-
Were entries concise? Did client use 4 W’s?
Look to what constituted a successful entry-
What made it successful?
How can this be used in the future?

Practise - Ask questions during session to get client to refer to DAILY DIARY.
  1. Open to this section and ask what it is used for
  2. Ask the client to read out an appointment that they have for the next week
  3. Ask the client to read out what they did last Wednesday
  4. Select date in the future and asks what happens on that day
  5. When do you check the DAILY DIARY?

Review use of TO DO LIST:
Was the To Do List used correctly?
Were new notes are made correctly and completed tasks are crossed out?
Practise - Ask questions during session to get client to refer to TO DO LIST.
  1. Open to this section and ask what it is used for
  2. Set homework (see below) and prompt client to add to do list
  3. Are there any particular tasks they need complete in the next week?
  4. When do you check the TO DO LIST?

Review PERSONAL INFORMATION:
Was the Personal Information section completed?
Practise - Ask questions during session to get client to refer to PERSONAL INFORMATION SECTION.
  1. Open this section and ask what it is used for
  2. Ask the details of person to contact in case of emergency
  3. Ask for address of friend
Training: Learning to use an alarm to reference the Filofax.
EL to associate alarm with referencing diary OR Training of support network to cue and assist reference to diary OR use of routine/whiteboard- write ‘check diary’ on board.

When referencing the organiser, the client should check recent, current and upcoming events.

In session: (after training use of alarm- see NK’s document)

Training- “When alarm sounds, check organiser”

**Demonstrate action**- alarm sounds NP checks the Filofax

**Vanishing cues:**
When alarm sounds, check organiser
When alarm sounds, check
When alarm sounds, ?
When alarm sounds, ? ?
When ?, ?, ?
? ?, ?, ?

**Expanded rehearsal:**
One minute
Two minutes
Five minutes
Ten minutes

Fill the break with conversation. If client forgets the association with the alarm, direct them to the Filofax.

Can follow expanded rehearsal by extending the time period that the client is able to refer to the whiteboard and make an entry/check information correctly without any prompts.

Demonstrate the use of the alarm to their support network.
When alarm sounds, check organiser

When alarm sounds, check  

When alarm sounds,  

When alarm  

When  

?  ?  ?  ?

?  ?  ?,  ?  ?

?  ?  ?,  ?  ?
DAILY DIARY (application phase)
Cancel an appointment
Make an appointment
Canceling one appointment and making another (after Donaghy & Williams, 1998).

A friend calls you and wants to make plans for next week. How do you know you are free?

If you decide to make plans with her, how will you remember to go?

What did you do last Thursday?

If the NP asks for you to bring something to the next session, how will you remember to do this?

Change in routine:
You had planned to catch the train/bus home from your appointment today. However, your neighbour has offered to drive you home instead as they will also be at the hospital. How will you remember to meet your neighbour?

You have been given a new prescription by your doctor and now have to take your usual tablet in the afternoon as opposed to the morning. How will you remember to do this?

Homework-
Ask client to bring a photo of them to the next session.
Ask client to send an email to NP before the next session.
Ask them to buy a birthday card for a relative/friend and to bring this to the next session.
Homework = entering information need to know.
Homework- enter the rest of important date and appointments.

** In the following week, NP to make a phone call or send an email/text to ask the subject to bring along a newspaper or book to the next session.
### Training use of Filofax session 2:

<table>
<thead>
<tr>
<th>Demonstration</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>When do I check the Filofax?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regularly</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Alarm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of daily diary section?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reminder</td>
<td></td>
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<tr>
<td>Temp note</td>
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<td></td>
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<tr>
<td>Weekly diary</td>
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<tr>
<td>Use of To do list?</td>
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<td></td>
</tr>
<tr>
<td>Use of Personal Information section?</td>
<td></td>
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<tr>
<td>Use of extra pages?</td>
<td></td>
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<tr>
<td>Note instructions</td>
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<tr>
<td>When do I review?</td>
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<tr>
<td>Start of day</td>
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<tr>
<td>Sunday</td>
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</tbody>
</table>
Session 3:

**Review use of organiser:**
Entering information- correct date? concise? 4 W’s?
Retrieving information- practise by asking what client had done/is going to do on particular dates etc.
Make note of number of entries (cf outcome measures).
Review homework.

**Focus on adaptation training:**
*Role plays. At earlier sessions, probe client for relevant examples. What tasks will they be doing? What do they have to remember?*
Invitation for dinner (phone from colleague’s office)
Reminder for meeting (phone)
Invitation to football
Reminder of relative’s birthday
Instructions regarding change to work schedule

*Discuss examples on Problem Solving Inventory*
E.g. forgetting to pay the phone or electricity bills, forgetting the details of medical appointments, forgetting social arrangements.
Feedback from support network.
Discuss real life community tasks and record use of organiser. Record accuracy and level of cue-ing required.

**Homework-**
e.g. Write a summary of the plot from a TV show they usually watch to bring to the next session or write a summary of a play/concert/movie they enjoyed recently.

Estimation of performance
Tick the box when you checked your Filofax at the following times…

<table>
<thead>
<tr>
<th>MONDAY</th>
<th>TUESDAY</th>
<th>WEDNESDAY</th>
<th>THURSDAY</th>
<th>FRIDAY</th>
<th>SATURDAY</th>
<th>SUNDAY</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

On that day, did you check your Filofax more often than these times? YES/NO
# Memo Minder Training Protocol

Training components and use of Memo Minder

<table>
<thead>
<tr>
<th>Demonstration</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is it used for? Reminder as I leave the house</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Where is it located? Front door 1 metre above ground</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>How do I record a message? Slide to record Press REC/PLAY Recording light 10cm from MIC Speak</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>How do I play message? Slide to auto Slide to play, press REC/PLAY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What setting should it be left on? Auto</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What do I do if message plays at random? Check that it is not near heat source</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Where is your HOME memory centre located?</td>
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<tr>
<td>How do you use your HOME memory centre? Items in same location. Organised</td>
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</tbody>
</table>
The Memo Minder can be used as a handy reminder to take important objects with you as you leave the house. It can also be used to remind you to perform certain actions before you leave a room, such as turning off the cooker or locking the door.

It is portable and so can be taken with you to the workplace if needed or used in different rooms (e.g. kitchen or front door). However, separate Memo Minders may be more suitable for different locations.

It is activated by a passive infrared motion detector and will pick up motion within a five meter range.

It records messages of up to 20 seconds. Once motion is detected, the message is played.

The Memo Minder uses 4 AA batteries and has a low battery indicator warning you of the need to change the batteries. However, the Memo Minder has low power consumption.

**Precautions:**
The Memo Minder is for indoor use only. Do not leave it where it will be exposed to direct sunlight or rain. The Memo Minder should also be kept away from direct heat sources such as heating units or refrigerators.
If the unit goes off at random, it is possibly located too close to a heating unit. Try a different location or direction of the unit to fix this problem.

During long period of disuse, the batteries should be removed.

LOCATION:
Place the Memo Minder on a table or hang it on a wall. The Memo Minder should be mounted one metre above the floor for the best coverage of the detection area.

HOW TO RECORD:
1. Slide function switch to REC position.
2. Hold REC/PLAY button on the front of the Memo Minder. The recording indicator will turn on.
3. Face the MIC, about 10cm away from your mouth. Start to record the message. You can record a message of up to 20 seconds.
4. To stop recording, release the REC/PLAY button.

HOW TO PLAY THE MESSAGE:
Automatically:
To automatically play message, slide function switch to AUTO. The message will play and automatically stop itself. When any person moves into the detection area the message will play automatically. The Memo Minder should be left in the AUTO mode.

Manually:
Slide the function switch to PLAY. The message will play back only when the REC/PLAY button is pressed.
** Note whether the Memo Minder worked correctly and if you remembered to take everything with you.

<table>
<thead>
<tr>
<th>Day</th>
<th>Worked correctly?</th>
<th>Remembered what I needed?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td></td>
<td></td>
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<tr>
<td>Time 1</td>
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<tr>
<td>Time 2</td>
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<td>Time 3</td>
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<tr>
<td>Tuesday</td>
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<tr>
<td>Time 1</td>
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<td>Time 2</td>
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<td>Time 3</td>
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<tr>
<td>Wednesday</td>
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<td>Time 1</td>
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<td>Time 1</td>
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<td>Time 1</td>
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<td>Time 2</td>
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<td>Time 3</td>
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<td>Saturday</td>
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<td>Time 1</td>
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<td>Time 3</td>
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<td>Sunday</td>
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<tr>
<td>Time 1</td>
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<tr>
<td>Time 2</td>
<td></td>
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<tr>
<td>Time 3</td>
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</tbody>
</table>

** Please note if you did not leave the house on that day
** Take this from with you as you leave the house. How will you remember to do this?
### Kitchen Timer training protocol
Training components and use of Kitchen Timer

<table>
<thead>
<tr>
<th>What is it used for?</th>
<th>Demo</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooking reminder</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Future task reminder</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Where is it located?</th>
<th>Demo</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the kitchen</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>How do I set the clock?</th>
<th>Demo</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press and hold CLOCK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Press H, M, S</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Press CLOCK to start</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How do I set count down timer?</th>
<th>Demo</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choose T1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Press H, M, S to select time you need</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Press START</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The timer symbol is solid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Press STOP to turn off alarm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Press CLEAR to reset</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>How do I set other timers?</th>
<th>Demo</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press T2, T3 or T4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Follow steps above</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How do I know if another timer is being used?</th>
<th>Demo</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>The timer symbol will flash</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How do I set the Count up timer?</th>
<th>Demo</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choose T1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Press START</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To stop, press STOP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To turn off press STOP then CLEAR</td>
<td></td>
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</tbody>
</table>
This kitchen timer contains a clock and four different timers. Each timer can count down or up. It can be useful when you are cooking—so that you don’t burn food or forget that you have something on the cooker—but can also be used to remind you of other future tasks.

TO SET THE CLOCK:

1. Press and hold CLOCK button for 3 seconds until digits flash.
2. Press H (Hours) M (Minutes) and S (Seconds) to set desired time.
3. Press CLOCK button to start the clock

* The CLOCK works independently of the timers. If timers are operating, T1, T2, T3 or T4 respectively will flash in the display.

TO SET THE COUNT DOWN TIMER:

1. Press T1 (Timer 1) to select a timer.
2. Press H, M and S to program the amount of time you need.
3. You can hold down the button to make the numbers change faster.
4. If you make a mistake, press CLEAR
5. Press START/STOP to activate the timer

6. The timer will count down in seconds.
7. When the time is up, an alarm will sound for one minute.
8. When the time is up (if the timer is not turned off), the timer will begin to count up.
9. Press STOP to stop the timer.
10. Press CLEAR to reset the timer to zero.

* Use this procedure to set the other timers.
* All timers can be used at the same time as each has its own distinctive alarm.
* To check how much time is left on a timer, press the button (T1, T2, T3, T4). A solid channel symbol indicates the count down time of the timer being used. A flashing timer symbol indicates other channels in operation.

**TO STOP/RESTART OR CLEAR COUNT DOWN TIMERS:**
1. Press the timer channel button.
2. Press START/STOP once.
3. To resume timing, press START/STOP button once.
4. To clear the timer, press STOP/START and then CLEAR. The display will go back to zero.

**TO SET COUNT UP/STOPWATCH TIMER:**
1. Press the timer button you want to use.
2. Press START/STOP. Time will begin to count.
3. To stop timing, press STOP/START. If you want to restart, press the STOP/START button again.
4. To turn the timer off, press STOP/START once and then the CLEAR button.
Tick the box when you used the kitchen alarm. What did you use the alarm for?

<table>
<thead>
<tr>
<th>MONDAY</th>
<th>TUESDAY</th>
<th>WEDNESDAY</th>
<th>THURSDAY</th>
<th>FRIDAY</th>
<th>SATURDAY</th>
<th>SUNDAY</th>
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</table>

On that day, did you use the cooker? YES/NO
Key Ringer training protocol

KEYRINGER

1. USE AND COMPONENTS

- Used for locating missing objects such as keys, eyeglasses, television remotes, purses and other items.
- There are two key rings to a pack, with batteries, magnetic tape and double sided foam tape.
- If the item you are attaching a key ringer to has a metal surface, use the magnetic tape. If you are only using one item, it may be useful to attach a keyringer to the refrigerator.
- If the item does not have a metal surface, attach the keyringer with the double sided tape.
- You can also attach a keyringer using the key ring loop.

2. HOW TO USE IT

- First select the items you want to find more easily e.g. keys, glasses etc.
- Attach one keyringer 1 to Item 1.
- Attach keyringer 2 to the fridge or to another item that you want find more easily (Item 2).

- To use the Keyringer, double click on the blue button. You will then hear 5 short beeps. Next the keyringer you are searching for will beep and flash for 15 seconds, allowing you to locate your lost item.
- If you do not find the lost item at first, click the blue button again.
- To stop the keyringer sooner, press the blue button again.

As noted, you can store the keyringer on the fridge. Alternatively, get into the habit of leaving one item with the keyringer in the same place within your house. Where is your HOME MEMORY CENTRE located?

IN SESSION EXAMPLES

- Training use of keyringer: Complete knowledge of components and use.

- Train steps:
  1. Double click blue button
  2. Five short beeps
  3. Listen for longer beeps
  4. Find item

  Double click blue button/5 short beeps/listen for longer beeps/?
  Double click blue button/5 short beeps/?/?
  Double click blue button/?/?/?
  ?/?/?/?
• Attach the key ringer to subject’s house keys. Hide the keys within the clinic room. Practise use of the keyringer across expanding delays:

One minute  ‘find your keys’
Two minutes ‘find your keys’
Five minutes ‘find your keys’
Ten minutes ‘find your keys’

If the subject does not know how to use the keyringer, ask them not to guess. Demonstrate use and halve the test interval.

• Hypothetical examples:
You are about to leave your house to go to the local shops for groceries. You cannot find your keys but you know where your glasses are. Both items have keyringers attached to them. How do you find your keys?

You have a keyringer attached to the fridge and to your glasses. You can’t find your glasses. How do you locate your glasses?
1. Double click blue button
2. Five short beeps
3. Listen for longer beeps
4. Find item

1. Double click blue button
2. Five short beeps
3. Listen for longer beeps
4. ?

1. Double click blue button
2. ?
3. ?
4. ?

1. ?
2. ?
3. ?
4. ?
### Training components and use of keyringer:

<table>
<thead>
<tr>
<th>Question</th>
<th>Demonstration</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is it used for? Locating objects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What is the keyringer attached to?</td>
<td>Fridge, Glasses, Keys</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>How do I attach keyringer?</td>
<td>Magnetic tape, double sided tape or key loop</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How do I use it? Attach to item, to fridge. Press blue button, listen for beeps, find item</td>
<td></td>
<td></td>
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<tr>
<td>If I do not find the item, I…? Press blue button again</td>
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</tr>
<tr>
<td>How can I stop the keyringer sooner?</td>
<td>Press blue button</td>
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<tr>
<td>Where is your HOME memory centre located?</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>How do you use your HOME memory centre?</td>
<td>Items in same location. Organised</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
St Thomas’ Memory Aids Clinic

Scutari Clinic
Ground floor, Adamson Centre
St Thomas’ Hospital

London SE1 7EH
What is KeyRinger?
KeyRinger is a locating device that uses sound waves. KeyRinger units “communicate” with each other, and you can use one KeyRinger to find another.

What do I get?
In the pack, you will be supplied with two KeyRinger units (with batteries already inserted), two double-sided foam tape strips, and one stick-on magnetic strip.

Where can I use KeyRinger?
You can attach a KeyRinger unit to almost anything using the foam tape, magnet, or keyring attachment. Attach the units to items that you frequently use, and that are important to have at hand, but are easily misplaced, e.g. house keys, wallet, handbag, or television remote control.

Some people find it useful to always keep one of the units in a set place – a good place is the fridge door using a magnetic strip. If you have only one item that you frequently lose, this may be the most practical application for you. However, unlike many location devices, KeyRinger units have a bi-directional line of communication, which means that either unit can operate as the “finder” to locate the other. Because of this feature, you may derive even greater benefit by attaching one unit to one important item, and the other to a second item, and then use whichever is in your possession to find the other. For example, you could have one attached to your purse and the other attached to your television remote control.

Scenario: You are about to leave your house to go to the local shop for groceries. You cannot find your purse, but you know where your television remote control is. You could then use the t.v. remote KeyRinger unit to find the missing purse.

As long as you know the location of one unit, you will be able to find the other. Of course, if the objects are often kept together (e.g. purse and handbag) – you may lose track of both simultaneously… at which point you will wish you’d used the fridge idea!

There are three ways of attaching a KeyRinger unit to an item. If possible, the most secure way is to use the key-ring loop, just as you would any other key-ring. If the item is made of magnetic-receptive metal, (the fridge door for example), then you can use the stick-on magnetic strip provided – peel off the protective backing and press the sticky side to the back of the KeyRinger. If the item will not hold a magnet, then you can use the double-sided foam tape – peel the protective backing from one side to reveal the sticky surface, and press that to the back of the KeyRinger unit; then peel the protective backing from the other side and press this sticky surface to the item in question.

Enabling the KeyRinger units:
KeyRingers are packed with white plastic tabs in place that prevent the battery circuit from connecting. To use your KeyRingers, remove the plastic tabs from both units by pulling them straight out and wigglng them slightly from side to side.

How do I use KeyRinger?
KeyRinger is very simple to use. There is only one button to press: the big, blue “FIND” button on the upper surface of the unit.
To use a KeyRinger, aim the sound deflector (see picture above) in the direction you think the missing item is most likely to be located. Then double click (press twice quickly) the FIND button, making certain that you are not blocking the sound signal, e.g. with a hand in front of the deflector.

If you are pointing in generally the correct direction, the missing KeyRinger will beep a loud alternating tone back at you for approximately 10 seconds, and the red light will flash. *KeyRinger’s range is approximately 300 feet.*

If nothing happens, try again. For convenience, the FIND button only needs to be clicked once if pressed within 15 seconds of a double-click activation.

*Still nothing?* Keep trying. In noisy environments it may be necessary to activate the KeyRinger 2-3 times before the misplaced KeyRinger responds. This is because the missing unit is ensuring that it is another KeyRinger it is hearing, and not just background noise. This is a feature designed to reduce the number of false activations.

*Still nothing?* Try pointing the sound deflector in a different direction – perhaps those missing keys are in the room behind you, rather than in front.

When the missing KeyRinger responds, you have 10 seconds of beeping and flashing to locate it – after that you will have to re-activate it by pressing the FIND button on your unit again. If you find your missing unit before it has finished beeping, you can deactivate the alarm by pressing its FIND button once.

**SAFETY PRECAUTIONS**

Do not hold a KeyRinger close to your ears or anyone else’s – the sound generated by the KeyRinger is loud enough to be painful if held too close to one’s ear.

So that you will not be startled, be aware that the KeyRinger will occasionally give off a false alarm due to random sounds being present in its locale.

*Batteries (CR2032)*

Each KeyRinger comes with two batteries that should last up to eighteen months. If the KeyRinger is kept in a noisy environment for extended periods of time, the battery
life will be shortened. You will need to replace the batteries when the unit fails to generate the full tone sequence, the light does not flash on a responding unit, or when the unit fails completely.

Replacement batteries can be bought at most computer retail stores, or through the KeyRinger website www.keyringer.com at a discount (although they ship from the USA).

To replace the batteries, separate the top and bottom halves of the KeyRinger unit by twisting a ten pence piece or large screwdriver in the slot located at the flat end of the case. After the case partially opens, work the coin or screwdriver around the case until the two halves separate. Remove the old batteries and install two new lithium batteries (CR2032), carefully observing which way up the + and – go.

The battery near the rounded end of the case must be installed + side UP. The battery near the flat end of the case must be installed + side DOWN.

Should you lose this leaflet and forget to observe which way up the batteries are inserted, there is a diagram of the correct polarities inside the case between the battery partitions.

**Ordering Information**

website: [http://www.keyringer.com](http://www.keyringer.com)
email: sales@keyringer.com

Sierra Systems
6728 Evergreen Avenue
Oakland
California 94611
USA
Tel: (001) 510-339-8200
Tick the box when you test the Key Ringer.

<table>
<thead>
<tr>
<th>MONDAY</th>
<th>TUESDAY</th>
<th>WEDNESDAY</th>
<th>THURSDAY</th>
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**Voice recorder training protocol**

**Session 1:**
Voice recorders can be used to make a quick reminder note or to record a longer sounds bite, such as a meeting or lecture. Voice recorders thus form part of a portable memory system. Like any portable memory aid, a system needs to be in place to ensure that it is taken from the house and not misplaced.

To help locate the voice recorder
- Make a memo to take the recorder as you leave the house.
- Leave it in an allocated place within your house/study.
- Place it by the door so it is not forgotten.
- Look before you leave to ensure that it is not left behind.

Once the message has been recorded, it can be played back
- Immediately,
- When required (e.g. where the car has been parked)
- At time of regular review (e.g. upon arrival to the workplace, home or at a set time each day). Make a reminder to review the voice recorder.

The message should be transferred to a more permanent store as appropriate- to a whiteboard, diary etc.

**In session examples:**
- Record details of next appointment.
- Record conversation with Neuropsychologist. Role play.

- If you met a friend in the street, who asked you to pass a message on to your partner/son, how would you use the voice recorder to help pass on the message? [role play within the session]

- If you had difficulty remembering where your car was parked, how could you use the voice recorder to remember this? [role play within the session].

- If you could not remember whether you had locked the front door, how could you use the voice recorder so that you did not have to walk back and check? [role play within session].

- You have an important meeting at work with your solicitor. How to you use the voice recorder to remember the meeting?

**Homework:** Bring voice recorder to the next session.
- Record details of meeting/lecture.
- Record details of meeting with doctor, solicitor etc.
- Record message to check front door, car lock etc.

**Prediction of performance.**
<table>
<thead>
<tr>
<th>Training components and use of voice recorder:</th>
<th>Demonstration</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is it used for?</td>
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<td>Temp note</td>
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<tr>
<td>Sounds recording</td>
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<tr>
<td>Where is it located?</td>
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<td>Portable memory system</td>
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<td>How do I remember to carry it?</td>
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<td>How do I turn it off?</td>
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<td>Slide HOLD</td>
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<td>How do I record a message?</td>
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<td>Select folder</td>
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<td>REC</td>
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<td>STOP</td>
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<td>How do I replay a message?</td>
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<tr>
<td>Folder/Index</td>
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<tr>
<td>Forward/back</td>
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<td>PLAY</td>
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<td>How do I adjust the volume?</td>
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<td>+ or -</td>
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<td>How do I erase a message?</td>
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<tr>
<td>Folder/Index</td>
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<td>ERASE</td>
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<td>Listen</td>
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<td>ERASE</td>
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</table>
**Session 2:**
Review components and use of voice recorder.

Review homework
- Number of recordings.
- How was the information transcribed to permanent store
- Comparison to prediction of performance.
- Any difficulties?

**Homework:**
Record meeting/lecture/class
Record some of meeting with doctor, solicitor
Record reminder to lock door, find car etc.

Mark in diary those reminders that were transferred.
Take photograph of whiteboard with reminder to review voice recorder and messages that were transferred.

**Session 3:**
Completion of homework- compare with prediction of performance. Were there any difficulties?

Review use of voice recorder- knowledge of components and how to use it.
Review transfer to a permanent store
Review portability of voice recorder.

Focus on metacognitive training with the Problem Solving Inventory.
EASY TO USE INSTRUCTIONS FOR THE SONY IC VOICE RECORDER

TO START

Batteries
First you will need to slide open the back cover by pressing down on the arrow. Then insert two AAA batteries, observing the correct polarity. Close the cover.

Setting the Time and Date
It is always useful to make sure the recorder is set to the correct time and date.
1. Press and hold down the FOLDER/MENU button. Press ►►I or I◄◄ to select SET DATE. Press ENTER.
2. Press ►►I or I◄◄ to select MANUAL.
3. You are now ready to set the date and time. The year indicator on the bottom right of the screen should be flashing. Press ►►I or I◄◄ to set the year, month, day hour and minute in sequence.
4. Press STOP once you have finished.

FOLDERS
An advantage of this model is that it has five different folders, A, B, C, D and E. These are easy to use and give you more space to store your voice recordings. Press the FOLDER/MENU button to select the folder in which you want to record messages. If you do not change folder after you stop recording, the next message will be recorded in the same folder.

To Record a Message:
1. Press the FOLDER/MENU button to select where you want to store your message.
2. Press the REC button to start recording.
3. Place the microphone at the top of the recorder close to the sound you want to capture.
4. Press STOP to stop recording.

To pause during recording, press the REC/PAUSE button. To then resume recording press the REC button again.

Each different recording has a number that is displayed on the middle of the screen. So for example the first sound you record will be 01. This will then be known as file 01.

You can store up to 99 files in each folder.

**To Play Back a Message**
1. Press the FOLDER/MENU button to select the desired folder.
2. Press the ►►I button or the I◄◄ to select a file to play back.
3. Press the PLAY button to start playback.
4. Press the + or – button to adjust the volume.

Press STOP to cancel playback in the middle of a recording. Press PLAY to start the recording again in the same place. Press the ►►I button to fast forward or the I◄◄ to rewind.

**To Erase a Message**
1. Select the message you want to erase when in STOP mode.
2. Press ERASE when you are playing back the message.
3. Press ERASE again.
4. To cancel erasing, press STOP before step 3.
Push button alarm training protocol

Using the push button alarm as a medication reminder:

- To remember to take medication at the right time, use record sheet and alarm.

- Review components of record sheet.
  Where will it be kept?
  How will it be carried- home and work?
  What pen will be used to complete the sheet?

- Use of Alarm to reference medication record sheet.
  COMPONENTS:
  Time
  Alarm on the hour
  Alarm on the half hour

Refer to NK’s information sheet
Complete training sheet for components

LEARNING TO TAKE MEDICATION WHEN THE ALARM RINGS.
1. Demonstration
2. EL to learn association

When alarm sounds, take medication
“When alarm sounds, take medication”
“When alarm sounds, take  ?”
“When alarm sounds,  ?  ?”
“When alarm  ?,  ?  ?”
“When  ?,  ?,  ?  ?”
“  ?,  ?,  ?,  ?”

PRACTICE: Then set the alarm to go off in
Two minutes

Five minutes

Ten minutes

If DK, don’t guess.
If DK or no response, direct to medication checklist.

Set the alarm to co-incide with routine- breakfast, lunch, dinner for example.

Homework: completion of medication record sheet

Training knowledge of components of push button alarm:
<table>
<thead>
<tr>
<th>Demonstration</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clock display</td>
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<tr>
<td>How do you set the clock?</td>
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<tr>
<td>Half hour alarm</td>
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<tr>
<td>How do you set a half hour alarm?</td>
<td>8.30am</td>
<td>1.30pm</td>
<td>9.30pm</td>
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<tr>
<td>Hour alarm</td>
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<tr>
<td>How do you set an hourly alarm?</td>
<td>12pm</td>
<td>3pm</td>
<td>10pm</td>
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<tr>
<td>Stop</td>
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<tr>
<td>How do you turn it off?</td>
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<tr>
<td>What is it used for?</td>
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<tr>
<td>Where will it be kept?</td>
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</tr>
<tr>
<td>Where are the batteries?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How do you change the batteries?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
When alarm sounds, take medication

When alarm sounds, take

When alarm sounds, ?

When alarm ?,

When ?,

?
WHAT IS THE MULTI-ALARM REMINDER?

• The **Multi-Alarm Reminder** is a small, battery-operated device that can be used to help you remember to do things.
• It is very easy to use.
• It can be set to give up to 31 daily alarms.
• The alarms can be set on the hour, from 8:00am to 11:00pm, or on the half-hour.
• Once an alarm has been set, it will go off every day at that time.

**To set the time** (This will probably have been done for you already)
1. Press **set** to enter the time setting mode – (hour digits starts blinking)
2. Press **hr / min** to set the hour and **AM / PM**
3. Press **set** to complete the hour setting (minute digits start blinking)
4. Press **hr / min** to set the minutes
5. Press **set** to finish setting the time
To set an alarm on the hour
1. Slide the switch on the top row that corresponds with the hour that you want the alarm to go off to the ON position.
2. The alarm that you have set will keep sounding for 10 minutes.
3. Press STOP to silence the alarm.

To set an alarm on the half-hour
1. Slide the switch on the bottom row that corresponds with the half-hour that you want the alarm to go off to the ON position.
2. Press STOP to silence the alarm.
3. The alarm that you have set will keep sounding for 10 minutes.
4. Press STOP to silence the alarm.

HOW CAN THE MULTI-ALARM REMINDER BE USEFUL?

As A Medication Reminder

The Multi-Alarm Reminder can be particularly useful as a reminder to take medication. Slide the switch ON for the times that you need to take your medication and make sure that you take it when you silence the alarm. Leave the switches ON so that the alarms will sound at the same times every day.

As an extra aid, it may be helpful to use a specially designed pill-box with the Multi-Alarm Reminder so that you can see easily whether or not you have taken your medication.

As A Reminder To Do Other Things

Used with other aids such as Post-It Notes or Post-It Tape, the Multi-Alarm Reminder can be used to remind you to do a number of different things. If you attach some Post-It Notes or Post-It Tape to the Multi-Alarm Reminder’s protective case you can use this to write down information about the alarms that you have set. You could set alarms to go off to remind you about:

- Appointments
- Meetings
- Something that you have to do at a particular time (e.g. make a telephone call)
- A television programme that you want to watch
- A radio programme that you want to listen to
SOME USEFUL TIPS

If you do set an alarm for an appointment, it is important to remember that it may take you time to get to that appointment, therefore allow for this when you set the alarm (i.e. if you have an appointment at 2:30pm and you know that it will take you half-an-hour to get there, set the alarm for 2:00pm).

If you set an alarm for an appointment or something else that you need to do only once, make sure that after you have pressed STOP you slide the appropriate switch to the OFF position.

Keep the Multi Alarm Reminder handy, for example in a shirt pocket or a handbag. Keep a thin pen inside the protective case.
Tick the box when you used the alarm. What did you use the alarm for?

<table>
<thead>
<tr>
<th>MONDAY</th>
<th>TUESDAY</th>
<th>WEDNESDAY</th>
<th>THURSDAY</th>
<th>FRIDAY</th>
<th>SATURDAY</th>
<th>SUNDAY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

On that day, did you use the alarm at other times? YES/NO What did you use the alarm for?
Pivotell medication box training protocol.

Training components and use of PivoTell Automatic Pill Dispenser

<table>
<thead>
<tr>
<th>What is it used for?</th>
<th>Demonstration</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>So I can take medication at the right time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>When do I restock the box?</th>
<th>Demonstration</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Once every 4 weeks/ 28 days</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What is the RECORD function?</th>
<th>Demonstration</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record of exact times that tablets were taken</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>When do I make note of the RECORD function?</th>
<th>Demonstration</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every Sunday night</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Where is it located?</th>
<th>Demonstration</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home memory centre</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Where is your HOME memory centre located?</th>
<th>Demonstration</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How do you use your HOME memory centre?</th>
<th>Demonstration</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How do I prepare the Pill Dispenser?</th>
<th>Demonstration</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select time disc</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attach time disc</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Add medication</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
from the right of the red section
Replace tray so red is visible
Add medication booklet

<table>
<thead>
<tr>
<th>SETTING AN ALARM</th>
<th>Demonstration</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Press Button 1 until repeatedly until ALARM is visible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Set Alarm 1 (1) using Buttons 2 or 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3. Press Button 1 again for second alarm.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Set Alarm 2 by pressing Buttons 2 or 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Press Button 1 to resume normal operation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How do I set the TYPE of alarm?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How do I set the FLASHING LIGHT alarm?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TO SET DOSE PER DAY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Press Button 1 until DOSES is visible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Wait a few seconds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Use Button 2 or 3 to adjust to number of doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Press Button 1 to resume normal operation</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
The PivoTell automatic pill dispenser is a memory aid that allows you to take your medication on time. The pill dispenser reminds the user by means of an alarm and flashing light when to take the medication. It will dispense the correct dose available at the correct time of day or night, whilst keeping the other pills locked and out of sight.

When the alarm sounds the internal tray will rotate one position. The correct dose will come into view in the lid opening. Pills should be removed from the dispenser by tilting it and pouring the pills into the hand or suitable container. This will cancel the alarm and flashing light.

The alarm will sound for up to one hour or until the pills are taken.

FILLING THE DISPENSER:

1. Time Discs.

There are a number of printed discs for 1 up to 4 medication prompts per day. Select the appropriate disc for your needs. Write in the times when you take your medication. Alternatively complete the blank disc if you take medication more than 4 times a day.

Place the disc on top of the tray. Bend down the paper tabs or secure it with a spot of glue or blu tac.
**Note when your first tablet will be taken. Start to the right of the red section.

Remove the tray.
Start from the right of the red section and place the correct dosage in each tray.
After filling, replace the tray so that the empty compartment marked by the red section will be visible through the opening.

Complete the medication booklet, place inside the case, slide the case under the dispenser and clip into position.

**DISPENSER SETTINGS:**

The clock, date and alarm type will have been set by the Memory Aids Clinic Neuropsychologist. You will need to set the number of doses per day and the alarm times.

1. **To set doses per day:**
Press Button 1 until “DOSES” is visible
Wait a few seconds. Adjust using Buttons 2 or 3 to the correct number of doses per day.
Press Button 1 for 3 seconds to restore normal operation.

2. **To set alarm times:**
Press Button 1 repeatedly until “ALARM” is visible.
Set the first alarm (1) time by using Buttons 2 or 3.
Press Button 1 again for the second alarm time and repeat the procedure for all other required alarms.
Press Button 1 for 3 seconds to restore normal operation.

**To turn off the alarm, tilt the dispenser to remove tablets.

The Pivotell automatic pill dispenser was purchased from:
Pivotell ltd
PO Box 108
Saffron Walden
CB11 4WX

Tel: 01799550979
sales@pivotell.co.uk
www.pivotell.co.uk
You can view the actual times the medication was dispensed with the RECORD function. Press Button 3 for three seconds, then Button 1 until ‘RECORD’ is displayed. The last time medication was taken is shown. Press Button 2 for the previous medication times to be shown.

** Once a week use the RECORD function to check the times that your medication was taken.

** How will you remember to complete this homework? That is, what other memory aids can you use to remember to review the RECORD function?

**

### Week 1: Time medication was dispensed.

<table>
<thead>
<tr>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time 1</td>
<td>Time 1</td>
<td>Time 1</td>
<td>Time 1</td>
<td>Time 1</td>
<td>Time 1</td>
<td>Time 1</td>
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<tr>
<td>Time 2</td>
<td>Time 2</td>
<td>Time 2</td>
<td>Time 2</td>
<td>Time 2</td>
<td>Time 2</td>
<td>Time 2</td>
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<tr>
<td>Time 3</td>
<td>Time 3</td>
<td>Time 3</td>
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<td>Time 3</td>
<td>Time 3</td>
<td>Time 3</td>
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<tr>
<td>Time 4</td>
<td>Time 4</td>
<td>Time 4</td>
<td>Time 4</td>
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<td>Time 4</td>
</tr>
</tbody>
</table>

**

### Week 2: Time medication was dispensed.

<table>
<thead>
<tr>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time 1</td>
<td>Time 1</td>
<td>Time 1</td>
<td>Time 1</td>
<td>Time 1</td>
<td>Time 1</td>
<td>Time 1</td>
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<td>Time 2</td>
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<td>Time 4</td>
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<td>Time 4</td>
</tr>
</tbody>
</table>
**Talking photo album training protocol**

**Training components and use of talking photo album:**

<table>
<thead>
<tr>
<th></th>
<th>Demonstration</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Comments</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is it used for?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attaching messages to photographs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Where is it located?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home memory system</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>When do I review?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As required</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As part of face/name training</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>How do I record a message?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hold red RECORD button</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Press grey ► button</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Release RECORD button</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How do I play a message?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Press ► button</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How do I erase a message?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Record over old message</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Play message</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hold red RECORD button</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Press grey ► button</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Release RECORD button</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Talking Photo Album

This photo album can hold 24 4” by 6” photographs and you can record a ten second message for each photograph.

The message can provide details of the person or the event when it is difficult to remember events that occurred in the past. A photograph and a message may also help to learn names and faces as part of a structured training program.

The talking photo album can also be used to create visual and audible step by step guides for domestic appliances, reminders, phones numbers or daily event schedules.

To record a message:
Hold down the red RECORD button and then press the grey play button ►. Make sure the red light has turned on and speak clearly, about four inches from the microphone (MIC). Release the RECORD button to stop recording. Repeat these steps to record more messages.

* When you have recorded for 10 seconds the recorder automatically stops recording and the red light indicator will turn off.

To Play message:
Press grey play button ► on each photograph.

To record a new message:
You need to record over the old message, starting from the beginning. Play the current message and then repeat the steps above to record a new message.
## Appendix 5: Neuropsychological test summaries for non-progressive case series

LB’s neuropsychological test performance in the Neuropsychiatry and Memory Disorders Clinic.

<table>
<thead>
<tr>
<th>Test Description</th>
<th>Raw score</th>
<th>Scaled score/percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Function</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WTAR</td>
<td>43/50</td>
<td>Est FSIQ = 106</td>
</tr>
<tr>
<td>WASI VIQ</td>
<td>113</td>
<td>(81st %ile)</td>
</tr>
<tr>
<td>WASI PIQ</td>
<td>100</td>
<td>(50th %ile)</td>
</tr>
<tr>
<td>WASI FSIQ</td>
<td>108</td>
<td>(70th %ile)</td>
</tr>
<tr>
<td>Block Design</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Matrix Reasoning</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Vocabulary</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Similarities</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Graded Naming Test</td>
<td>16/30</td>
<td>10-25th %ile</td>
</tr>
<tr>
<td><strong>Memory Function</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doors and People: People</td>
<td>14</td>
<td>(91st %ile)</td>
</tr>
<tr>
<td>Doors and People: Names</td>
<td>10</td>
<td>(50th %ile)</td>
</tr>
<tr>
<td>Doors and People: Shapes</td>
<td>9</td>
<td>(37th %ile)</td>
</tr>
<tr>
<td>Doors and People: Doors</td>
<td>6</td>
<td>(9th %ile)</td>
</tr>
<tr>
<td><strong>Executive Function</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal fluency</td>
<td>62</td>
<td>&gt;90th %ile</td>
</tr>
<tr>
<td>Hayling Part 1 time</td>
<td>2 secs</td>
<td>6 (50th %ile)</td>
</tr>
<tr>
<td>Hayling Part 2 time</td>
<td>21 secs</td>
<td>6 (50th %ile)</td>
</tr>
<tr>
<td>Hayling Part 2 errors</td>
<td>7</td>
<td>(75th %ile)</td>
</tr>
<tr>
<td>Brixton Spatial Anticipation Test</td>
<td>28 errors</td>
<td>1st %ile</td>
</tr>
</tbody>
</table>

**Legend:** Bold indicates impairment according to published norms for standardised tests. WTAR = Wechsler Test of Adult Reading (Wechsler, 2001), Wechsler Abbreviated Scale of Intelligence (WASI, Wechsler, 1999), VIQ = verbal intelligence quotient, PIQ = Performance intelligence quotient, FSIQ = Full scale intelligence quotient, Doors and People = Doors and People battery (Baddeley et al., 1994); Hayling = Hayling Sentence Completion Test (Burgess & Shallice, 1997).
LB’s neuropsychological performance in the Memory Aids Clinic at baseline and follow-up.

<table>
<thead>
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<td>PS = 2</td>
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**Legend:** Bold indicates impairment according to published norms for standardised tests. RBMT E = Rivermead Behavioural Memory Test-Extended version (Wilson et al., 1999), WAIS3 = Wechsler Adult Intelligence Scale Third edition (Wechsler, 1997), Digit Sym = Digit Symbol subtest from WAIS3, Lett/No = letter number sequencing subtest from WAIS3, TEA= Test of Everyday Attention (Robertson et al., 1994), El Count = Elevator Count subtest, Tel Search = Telephone Search, Tel Search + Count = Telephone Search While Counting, BADS = Behavioural Assessment of the Dysexecutive Syndrome (Wilson et al., 1994), PS = profile score.
WR’s neuropsychological test performance in the Neuropsychiatry and Memory Disorders Clinic.

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**Legend:** Bold indicates impairment according to published norms for standardised tests. NART-R = National Adult Reading Test-Revised (Nelson & Willison, 1991); Wechsler Abbreviated Scale of Intelligence (WASI, Wechsler, 1999); WMSR = Wechsler Memory Scale-Revised (Wechsler, 1997); RCFT = Rey Complex Figure Test (Rey, 1941); Graded Naming Test (McKenna & Warrington, 1983); Trail Making Test (Reitan, 1958); Hayling = Hayling Sentence Completion Test (Burgess & Shallice, 1997).
WR’s neuropsychological test performance in the Memory Aids Clinic at baseline and follow-up.

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**Legend:** Bold indicates impairment according to published norms for standardised tests. NART-R = National Adult Reading Test-Revised (Nelson & Willison, 1991); Wechsler Abbreviated Scale of Intelligence (WASI, Wechsler, 1999), Vocab = Vocabulary subtest from WASI, MReason = Matrix Reasoning subtest from WASI, RBMT E= Rivermead Behavioural Memory Test-Extended version (Wilson et al., 1999), WAIS3 = Wechsler Adult Intelligence Scale Third edition (Wechsler, 1997), Digit Sym = Digit Symbol subtest from WAIS3, Lett/No = letter number sequencing subtest from WAIS3, TEA= Test of Everyday Attention (Robertson et al., 1994), El Count = Elevator Count subtest, Tel Search = Telephone Search, Tel Search + Count = Telephone Search While Counting, BADS = Behavioural Assessment of the Dysexecutive Syndrome (Wilson et al., 1996), PS = profile score, n.t. = not tested.
JG’s neuropsychological test performance in the Neuropsychiatry and Memory Disorders Clinic.

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**Legend:** Bold indicates impairment according to published norms for standardised tests. NART-R = National Adult Reading Test-Revised (Nelson & Willison, 1991); Wechsler Abbreviated Scale of Intelligence (WASI, Wechsler, 1999), Graded Naming Test (McKenna & Warrington, 1983), Doors and People = Doors and People battery (Baddeley et al., 1994).
JG’s neuropsychological test performance in the Memory Aids Clinic at baseline and follow-up.

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**Legend:** Bold indicates impairment according to published norms for standardised tests. National Adult Reading Test-Revised (Nelson & Willison, 1991); Wechsler Abbreviated Scale of Intelligence (WASI, Wechsler, 1999), Vocab = Vocabulary subtest from WASI, MReason = Matrix Reasoning subtest from WASI, RBMT E = Rivermead Behavioural Memory Test-Extended version (Wilson et al., 1999), WAIS3 = Wechsler Adult Intelligence Scale Third edition (Wechsler, 1997), Digit Sym = Digit Symbol subtest from WAIS3, Lett/No = letter number sequencing subtest from WAIS3, TEA= Test of Everyday Attention (Robertson et al., 1994), El Count = Elevator Count subtest, Tel Search = Telephone Search, Tel Search + Count = Telephone Search While Counting, BADS = Behavioural Assessment of the Dysexecutive Syndrome (Wilson et al., 1996), PS = profile score, n.t. = not tested.
Appendix 6: Neuropsychological test summaries for progressive case series

CC’s neuropsychological test performance in the Neuropsychiatry and Memory Disorders Clinic.

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</tr>
<tr>
<td>WMSR VR I</td>
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<td>35\textsuperscript{th} %ile</td>
</tr>
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<td>RMT Words</td>
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<td>RMT Faces</td>
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<td>&lt;5\textsuperscript{th} %ile</td>
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Legend: Bold indicates impairment according to published norms for standardised tests. WTAR = Wechsler Test of Adult Reading (Wechsler, 2001), Wechsler Abbreviated Scale of Intelligence (WASI, Wechsler, 1999), VIQ = verbal intelligence quotient, PIQ = Performance intelligence quotient, FSIQ = Full scale intelligence quotient, WMSR = Wechsler Memory Scale-Revised (Wechsler, 1997); LM = Logical Memory subtest from WMSR; VR = Visual Reproduction subtest from WMS-R; RMT = Recognition Memory Test (Warrington, 1984).
CC’s neuropsychological test performance in Memory Aids Clinic at baseline and follow-up.

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**Legend:** **Bold** indicates impairment according to published norms for standardised tests. NART-R = National Adult Reading Test-Revised (Nelson & Willison, 1991); Wechsler Abbreviated Scale of Intelligence (WASI, Wechsler, 1999), Vocab = Vocabulary subtest from WASI, MRreason = Matrix Reasoning subtest from WASI, RBMT E = Rivermead Behavioural Memory Test-Extended version (Wilson et al., 1999), WAIS3 = Wechsler Adult Intelligence Scale Third edition (Wechsler, 1997), Digit Sym = Digit Symbol subtest from WAIS3, Lett/No = letter number sequencing subtest from WAIS3, TEA= Test of Everyday Attention (Robertson et al., 1994), El Count = Elevator Count subtest, Tel Search = Telephone Search, Tel Search + Count = Telephone Search While Counting, BADS = Behavioural Assessment of the Dysexecutive Syndrome (Wilson et al., 1996), PS = profile score, SS = scaled score, n.t. = not tested.
IBs neuropsychological test performance in the Neuropsychiatry and Memory Disorders Clinic.

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<td>MCST perseverative errors</td>
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**Legend:** Bold indicates impairment according to published norms for standardised tests. NART-R= National Adult Reading Test-Revised (Nelson & Willison, 1991); WAIS3 = Wechsler Adult Intelligence Scale Third Edition (Wechsler, 1997); VCI = verbal comprehension index; PRI = perceptual reasoning index; WMI = working memory index; PSI = processing speed index; WMS-R = Wechsler Memory Scale-Revised (Wechsler, 1989); LM = Logical Memory subtest from WMS-R, VR = Visual Reproduction subtests from WMS-R, RMT = Recognition Memory Test (Warrington, 1984), MCST = Modified Card Sorting Test, (Nelson, 1976).
IB’s neuropsychological test performance in Memory Aids Clinic at baseline and follow-up.

<table>
<thead>
<tr>
<th></th>
<th>BASELINE</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>BADS zoo map</td>
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<tr>
<td>Brixton</td>
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**Legend: Bold** indicates impairment according to published norms for standardised tests. Wechsler Abbreviated Scale of Intelligence (WASI, Wechsler, 1999), Vocab = Vocabulary subtest from WASI, MReason = Matrix Reasoning subtest from WASI, RBMT E= Rivermead Behavioural Memory Test-Extended version (Wilson et al., 1999), WAIS3 = Wechsler Adult Intelligence Scale Third edition (Wechsler, 1997), Digit Sym = Digit Symbol subtest from WAIS3, Lett/No = letter number sequencing subtest from WAIS3, TEA= Test of Everyday Attention (Robertson et al., 1994), El Count = Elevator Count subtest, Tel Search = Telephone Search, Tel Search + Count = Telephone Search While Counting, BADS = Behavioural Assessment of the Dysexecutive Syndrome (Wilson et al., 1996), PS = profile score, SS = scaled score, n.t. = not tested.
BB’s neuropsychological test performance at baseline and follow-up.

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**Legend:** **Bold** indicates impairment according to published norms for standardised tests. NART-R = National Adult Reading Test-Revised (Nelson & Willison, 1991); Wechsler Abbreviated Scale of Intelligence (WASI, Wechsler, 1999); Vocab = Vocabulary subtest from WASI; MReason = Matrix Reasoning subtest from WASI; RBMT E = Rivermead Behavioural Memory Test-Extended version (Wilson et al., 1999); WAIS3 = Wechsler Adult Intelligence Scale Third edition (Wechsler, 1997); Digit Sym = Digit Symbol subtest from WAIS3; Lett/No = letter number sequencing subtest from WAIS3; TEA= Test of Everyday Attention (Robertson et al., 1994); El Count = Elevator Count subtest, Tel Search = Telephone Search, Tel Search + Count = Telephone Search While Counting, BADS = Behavioural Assessment of the Dysexecutive Syndrome (Wilson et al., 1996); PS = profile score, SS = scaled score, n.t. = not tested.