A Thesis Submitted in Partial Fulfilment of the Registration for the Degree of Doctor of Clinical Psychology in the University of Birmingham

Volume One:
Research Component

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June 2009

ACKNOWLEDGEMENTS

I would like to say a big thank you to the following people:

Dr Theresa Powell for all your support, guidance, and frequent running up and down the stairs at university.

Professor Nick Alderman for your help, support, sense of humour, and encouragement during the long data collection days.

The rest of the staff at Kemsley for their generous help and support in recruiting participants.

My family, friends, and course mates, for their support, encouragement and going through this process with me

Finally, and most importantly, all of the participants that took the time to take part in the research. Meeting you all made this process enjoyable and worthwhile.

OVERVIEW

This thesis is submitted in part fulfilment for the degree of Doctor of Clinical Psychology (ClinPsychD) at the University of Birmingham. It contains both the research component and five clinical practice reports of clinical work that was undertaken during the three years of the course.

Volume One of the thesis contains three papers. The literature review examines evidence on interventions for the rehabilitation of executive functioning. It has been written with the intention to submit to the journal: Neuropsychological Rehabilitation. The empirical study is the second paper. This examines the impact of verbal and visual/verbal feedback on awareness of errors and performance on a planning task. This has been written with the intention to submit to the journal: Neuropsychological Rehabilitation. The third paper is the public domain briefing paper which gives an overview of the literature review and empirical paper.

Volume Two contains five clinical practice reports. The first report describes a 31year-old man with depression, formulated from a cognitive and psychodynamic framework. The second report is a small-scale service related project which evaluates the process of setting up a personality disorder service by a local PCT. The third is a single-case experimental design, with a man with severe learning disabilities, displaying agitated behaviour. The fourth is a case study report of a psychological intervention with a woman experiencing loss, adjustment and relationship difficulties. The final report is the abstract from an oral presentation of a small-scale service related project on a community psychology child placement.

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Literature Review

How Effective are Interventions to Rehabilitate Executive Functioning Following Traumatic Brain Injury?

Prepared for submission to
Neuropsychological Rehabilitation

Abstract

Purpose: The purpose of this review was to assess the effectiveness of interventions to rehabilitate executive functioning following TBI.

Results: Seven papers met the inclusion criteria. Three of the studies used a multi-strategy instruction (MSI) approach; one study used a combination of feedback, education, and reasoning, one paper used a combination of MSI and feedback, education and reasoning; and three studies used problem-solving techniques that drew on analogy or previous experiences. Two of the studies provided Class I evidence for the use of MSI approaches; whilst one study provided Class II evidence for a problem-solving strategy involving the use of previous experiences.

Conclusions: This review provided added evidence for the use of MSI as an intervention approach. Further research on the use of previous experience is required before it can be classified as Class I evidence. Other areas of research suggested by the review include the use of analogies to aid problem-solving, the use of computer generated simulations of real-life situations to learn problem-solving skills, and using Goal Management Training to treat executive problems resulting from cerebellar damage.

Introduction

The consequences of a Traumatic Brain Injury (TBI)[1] can be significant and wide-ranging, impacting on physical, cognitive, emotional and social functioning. Executive functioning is an area of cognition that is often affected by TBI. It has traditionally been defined as a set of "integrated cognitive processes that determine goal-directed and purposeful behaviour… including: the ability to formulate goals; to initiate behaviour; to anticipate the consequences of actions; to plan and organise behaviour according to spatial, temporal, topical or logical sequences; and to monitor and adapt behaviour to fit a particular task or context" (Cicerone et al., 2000). Hence, complex skills such as problem-solving, planning, initiation, multi-tasking, self-monitoring, and error correction require the executive functioning system. This system is thought to operate by regulating more basic cognitive systems, such as attention, memory, social behaviour and comprehension to undertake complex, goal-directed and purposeful behaviour (Kennedy et al., 2008). In the present review the most recent literature pertaining to the rehabilitation of executive functioning will be evaluated.

Current guidelines and recommendations

Research into the rehabilitation of executive functions has spanned three decades. In recent years Cicerone and colleagues have undertaken two systematic reviews on cognitive rehabilitation interventions (Cicerone et al., 2000; Cicerone et al., 2005). These reviews

[1] Traumatic Brain Injuries are open and closed head injuries resulting from physical trauma. The term does not apply to brain injuries that are congenital, degenerative, or induced by birth trauma.

covered the rehabilitation of attention, visuo-spatial, language and communication, memory and executive functioning deficits. In the original paper published in 2000 the authors found fourteen studies with the goal of improving executive functioning. In a follow-up review published in 2005 a further nine studies published between 1998 and 2002 were identified. Studies in both of these reviews were assigned to one of four classes of evidence and recommendations were given according to the class of evidence that was available. These recommendations were broken down into *practice standards* which were based on at least 1, well-designed Class I study, or overwhelming Class II evidence; *practice guidelines* which were based on well designed Class II studies; and *practice options* which were based on Class II and Class III studies.

The authors concluded that training in formal problem solving strategies should be a *practice guideline*, whilst interventions that promote internalisation of self-regulation strategies through self-instruction and self-monitoring should be a *practice option*. The Cicerone papers do not specifically define what they mean by ‘formal problem solving strategies’ but it appears to mean approaches that use techniques to break complex problems down into manageable steps. The evidence was not sufficient to provide any *practice standards* (Cicerone et al., 2000; Cicerone et al., 2005).

Kennedy et al. (2008) also performed a systematic review that concentrated solely on interventions for executive functioning. Databases were searched through to 2004 and 35 studies were initially identified. Twenty of these studies concentrated on self-awareness or self-regulation of attention, behaviour and memory. As reviews of these areas had recently been undertaken Kennedy et al. (2006) did not include these papers (see Fleming &

Ownsworth, 2006; Kennedy & Coelho, 2005; Ylvisaker et al., 2007 for reviews). This left a total of fifteen studies that focussed on the following aspects of executive functioning: problem-solving, planning, organisation and multi-tasking[2].

There were three types of intervention that were used by the studies in the review: training multiple steps, including metacognitive strategy instruction approaches (MSI); training strategic thinking through verbal reasoning; and training multitasking. Some of the studies used a combination of training strategic thinking and training multi-tasking. MSI approaches use step-by-step procedures that utilise 'direct instruction to teach individuals to regulate their own behaviour by breaking complex tasks into steps while thinking strategically' (Kennedy et al., 2008). There was some consensus across studies that the steps should include 'acknowledging and / or generating goals, self-monitoring and self-recording of performance, and strategy decisions based on the performance-goal comparison in which individuals adjust the plan based on self-feedback or external feedback' (Kennedy et al., 2008).

Each of these studies was classified for the quality of evidence that they provided by using the initial classification system used by the Quality Standards Subcommittee of the American Academy of Neurology (ANN) (Miller et al., 1999). This used three levels of classification and described recommendations as either practice standards, guidelines or options. This review differed from the Cicerone reviews as it included a quantitative analysis of the papers, as well as a qualitative analysis. The quantitative analysis involved estimating effect sizes and conducting a meta-analysis on a subset of the group intervention studies.

[2] In the Cicerone et al. reviews (2000 & 2005) there was a combined total of twenty three studies, whilst in the Kennedy et al. (2008) review there were fifteen studies. These reviews shared seven studies in common. The difference in the total number of papers and those that were shared between the reviews may be accounted for by two factors. Kennedy et al. (2008) included more search terms in its methodology and also a more stringent selection of papers, including only papers on problem-solving, planning, organisation and multi-tasking.

The authors recommended that MSI approaches should be a *practice standard* for young to middle-aged adults with TBI, for difficulties with problem solving, planning, and organisation. No other recommendations could be given based on the evidence assessed.

Aim

Kennedy et al. (2008) note in their conclusion that the evidence base supports intervention for executive functioning deficits but much needs to be learned about specific intervention techniques. As noted above, the Kennedy et al. (2008) review included papers up to 2004. The aim of the present paper is therefore to review the most recent literature on interventions for deficits in executive functioning, specifically the aspects studied by Kennedy et al. (2008) – problem-solving, planning, organisation and multi-tasking. It is hoped that since the last review was undertaken further studies will provide better evidence for specific intervention techniques. The studies will be methodologically evaluated and recommendations for clinical practice will be provided based on the American Academy of Neurology (AAN) quality standards (see below) and previous reviews discussed above.

Method

As stated, this paper aims to update the review undertaken by Kennedy et al. (2008) and it therefore follows the same methodological strategies used by them. Searches were performed using the following keywords: *traumatic brain injury, brain inju**[3], *head injur*, brain concussion, brain damage, closed head injury, and head trauma* for the population*; executive function*, metacognition, awareness, self-aware*, plan*, problem solving, self-monitor*, self-control, strategies, individualized instruction, self-instruction, self-regulation, metamemory, goals,* and *reasoning* for the disability of interest*;* and *intervention, treatment, compensation, therapy, train*, remediation, cognitive rehabilitation,* and *rehabilitation* for therapy. The search terms employed by Kennedy et al. were used and expanded on by including suggestions created by the databases searched. These databases were: PsychINFO, MEDLINE, Web of Science, Cumulative Index to Nursing and Allied Health Literature (CINAHL), and ERIC. The search was limited to studies that had been published since 2005, and that were published in English. A total of 236 papers were found using this method. The reference lists of relevant books, chapters, studies, and reviews were also searched for papers that may have been missed. However, no extra papers were found using this method.

The abstracts of the articles were then searched through to find papers that met the inclusion and exclusion criteria for this review. The inclusion criteria were:

- Studies concentrating on problem solving, planning, organization and multi-tasking (following Kennedy et al., 2008).

[3] Words with an * after them indicate truncated words that can be finished with a number of different relevant endings – e.g. brain injur* could become brain injuries, brain injury, or brain injured. This operation is performed automatically by the search databases.

- Studies including some aspect of problem solving, planning, organization and multi-tasking as part of a wider study of cognitive functioning.
- Studies with defined outcome measures.

The exclusion criteria were:

- Reviews.
- Theoretical papers.
- Studies examining other aspects of executive functioning, such as emotion regulation.
- Studies pertaining to pharmacological interventions.

An initial 12 studies were selected from the 236. These were then reviewed with a research supervisor and a further 5 were removed. When looked at in more detail these articles did not meet some of the inclusion or exclusion criteria. This left a total of 7 papers.

Kennedy et al. (2008) utilized the first version of a classification system adopted by the American Academy of Neurology (AAN). This was subsequently updated in 2004 and it is this version that was used here (Edlund, Gonseth, So, & Franklin, 2004). This classifies research into four classes – I, II, III and IV. Class I studies are normally RCTs; Class II studies are matched group cohort studies or less rigorous RCTs; Class III studies are other controlled trials where outcome is independently assessed; and Class IV studies are uncontrolled, for example case series, case reports, or expert opinion (see Appendix 1 for a detailed description of each of these classes). However, the guidelines also allow for an RCT to be classified as a Class IV study when random sampling techniques have been used but there are other methodological problems e.g. no independent assessment of outcome.

To help determine a studies' design a flow diagram in The Guidelines Manual published by the National Institute for Health and Clinical Excellence (National Institute of Health and Clinical Excellence, 2007) was used (see Appendix 2). This defines an RCT as any study that randomly selects and allocates participants to conditions.

This review also follows the format for providing clinical recommendations that the AAN recommends (Edlund et al., 2004). This uses descriptive language to provide guidance. The four levels of recommendation are as follows: "should be done or, should not be done"; "should be considered or, should not be considered"; "may be considered, or may not be considered"; and a category for insufficient data.

A table of evidence was constructed to evaluate the methodological quality of the studies (see Appendix 3). This included the important features of studies that were identified by Kennedy et al. (2008) and other aspects identified by the AAN (Edlund et al., 2004).

Results

Of the seven studies that met the inclusion and exclusion criteria two were Class I studies and five were Class IV studies. The interventions employed fell into three categories: (i) Metacognitive Strategy Instruction (MSI) approaches, (ii) feedback, education, and reasoning, and (iii) using analogies or previous experiences to help solve problems. Most of the studies used a single intervention approach; however one (Ownsworth, Fleming, Shum, Kuipers, & Strong, 2008) used a combination of MSI and feedback, education, and reasoning. Table 1 provides a summary of the types of interventions used, whilst Table 2 provides a summary of the main aspects of each of the studies.

Table 1: Summary of the types of intervention used in the studies reviewed

Type of intervention	What it involves
Metacognitive Strategy Instruction (MSI) approaches	Training to: • Acknowledge and / or generating goals • Break down complex tasks into manageable steps • Self-monitoring and self-recording of performance • Strategy decisions based on the performance-goal comparison in which individuals adjust the plan based on self-feedback or external feedback
Feedback, education and reasoning	An approach that uses a combination of feedback on performance, education about strategies for improving effectiveness (e.g. therapists modelling strategies), and a process of verbal reasoning. The reasoning aspect concentrates on discussion about reasons for using strategies and/or participants explaining their reasons for using strategies
Training in use of analogy / previous experience to solve problems	Training to use similar problems / solutions and previous experience to solve new problems

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Table 2: Summary of the studies included in this review

Author& Year of Publication	*Study type & Level of evidence*	*Participants*	*Type of intervention, description and length*	*Comparison*	*Follow up & Length*	*Outcome measures*	*Results*
Hewitt, Evans, & Dritsche (2006)	RCT Class I	n=30	Training in use of analogy / previous experience to solve problems Autobiographical memory cueing procedure 30 minutes training	Pre and post intervention within group Control group – no training (n=15)	No follow up	Responses to Everyday Descriptions Task – (a)Effectiveness of plan, (b)number of steps in plan	No significant main effect of group for: (a) effectiveness of plan or (b) number of steps in a plan However, significant group by time interactions on (a) and (b) suggest that the intervention contributed to improvement in scores
Ownsworth, Fleming, Desbois, Strong, Kuipers (2006)	Single-case experimental design –ABC and AB designs Class IV	n=1	MSI approach Training in self-awareness of errors and use of self-regulation strategies to correct errors, including content-free alerting 16 week intervention	Baseline and after treatment comparisons	No follow up	Error frequency during cooking task and voluntary work Error behaviour during cooking task	Error behaviours: Baseline – self corrected errors 4-15% of errors Treatment – self corrected errors 9-27% of errors Maintenance – self corrected 25-46% or errors Error frequency: Cooking task Baseline – average 21 Treatment – average 11.8 (44% reduction) Maintenance – average 11

							Voluntary work: Baseline – average 12.3 Treatment – average 7.5 (39% reduction)
Ownsworth, Fleming, Shum, Kuipers, Strong (2008)	RCT Class I	n=35	Combination of MSI and Feedback, education, and reasoning approaches 1. Group-based programme (feedback, education, and reasoning) 2. Individualised occupation based support (MSI) 3. Combined group and individual programme 24 hours over 8 weeks	Pre and post intervention between group analysis Waiting list group – no training (n=17)	3 months	Canadian Occupational Performance Measure (COPM) Patient Competency Scale (PCRS) The Brain Injury Community Rehabilitation Outcome 39 (BI-CRO-39)	Summary Significant improvement in self and relative COPM ratings of performance and satisfaction observed for combined and individual interventions pre and post assessment, but not for the group intervention Gains in behavioural competency and psychological well-being were found to occur more frequently following individual and group interventions Waiting list controls – no change on pre and re-assessment outcome

Satish, Streufert, & Eslinger (2008)	Case study Class IV	n=1	Feedback, education, and training approach Assessment of cognitive skills through detailed simulation-based computer programme Intervention programme targeted low performance areas Weekly training over 3 months	Pre and post intervention	No follow up	Scores on Strategic Management Simulation (SMS) measures - 25 measures	Improvements in 17 out of 25 measures on SMS and particularly evident in 9 of the 17
Schweizer, Levine, Rewilak, O'Connor, Turner, Alexander et al. (2008)	Case study Class IV	n=1	MSI approach Goal Management Training 7 week rehabilitation programme	Pre and post intervention	48 days post rehab.	Sustained Attention to Response Task (SART) Delis-Kaplan Executive Function System Tower Test (D-KEFS Tower Test	R-SAT and Hotel Task at ceiling pre-intervention SART pre-intervention errors - 18; post-intervention errors - 7 D-KEFS Tower Test pre-intervention 19/30, post-intervention 21/30

						Revised-Strategy Application Test (R-SAT) Hotel Task; Dysexecutive Questionnaire (DEX) Cognitive Failures Questionnaire (CFQ)	DEX self pre-intervention rating 1, post-intervention rating 2 DEX other pre-intervention rating 11, post-intervention rating 0 CFQ pre-intervention rating 0; post-intervention rating 7
Soong, Sing-Fai Tam, Wai-Kwong Man, Hui-Chan (2005)	RCT Class IV	n=15	Training in use of analogy / previous experience to solve problems 3 versions of analogical problem-solving training programme: computer assisted programme; online interactive computer assisted	Pre and post assessment within group Between group comparison of different training programmes (n=5 for each group)	No follow up	Category test for adults (from the Halstead-Reitan neuropsychological test battery) Hong Kong Chinese version of Lawton instrumental activities of	Significant difference between baseline and post measurements for Category Test and Lawton IADL scale p=0.00. No significant difference between groups on pre and post measures of self-efficacy and problem solving. No difference between mode of treatment delivery

			programme; therapist-administered programme 20 session intervention			daily living scale Daily self-efficacy and problem solving checklists	
Wai-Kwong Man, Soong, Sing-Fai Tam, & Hui-Chan (2006)	RCT Class IV	n=50	Training in use of analogy / previous experience to solve problems Analogical problem-solving training programme included: skill building through teaching thinking and problem solving skills through use of analogies; supportive and reflective feedback provided 20 session intervention	Pre and post intervention within group Control group – no training (n=20)	No follow up	Problem solving quizzes Category test for adults (from the Halstead-Reitan neuropsychological test battery) Hong Kong Chinese version of Lawton instrumental activities of daily living scale	Training Group: Lawton IADL - pre-training score of 17.73, post-training score of 19.33, $p<0.0005$; Category test pre training score of 84.90, post-training score of 76.33, $p<0.0005$; 6 out of 19 quizzes reached significance Control Group: Lawton IADL - pre-test score of 17.53, post-test score of 19.40, $p<0.15$; Category test pre-test score of 78.33, post-test score of 73.33, $p<0.1$; Problem quizzes pre-test mean 17.89, post-test mean 16.76, $p<0.17$

MSI approaches

Three of the seven studies in this review used MSI (Sohlberg, Ehlardt, & Kennedy, 2005). In the Kennedy et al. (2008) review MSI is classified as a Practice Standard with young and middle aged adults. The two studies that used only MSI will be reviewed in this section whilst the study that combined MSI and feedback, education, and reasoning will be reviewed later on.

Ownsworth, Fleming, Desbois, Strong, and Kuipers (2006) employed a single-case AB and ABC design, where A was the baseline phase, B the treatment phase, and C the maintenance phase. This was therefore classified as a Class IV study. The study aimed to validate an intervention for improving the metacognitive skills of a person that had suffered a TBI and had executive functioning and awareness deficits. The initial phase included discussion with the participant about his goals. Two real-life settings were identified as the target for the intervention, cooking at home and volunteer work. The intervention focussed on improving awareness of errors and self-correction. In the first session the participant observed his mother cooking and then used a step-by-step recipe to cook the same meal. An alerting tone was used every 3 minutes to remind the participant to check the recipe and review what he was doing. After he had finished cooking the participant reviewed what he had done and received feedback from the therapist. In the next session the participant was shown a video tape of his cooking session and was encouraged to stop it when errors were identified and come up with corrective actions. The participant then cooked the same meal again. Future sessions involved pre-cooking discussion, the participant cooking the meal with alerting tones, reviewing what they had done and getting feedback. A four-week maintenance period was also used where the alerting tone was withdrawn and the participant's mother provided prompts and feedback.

During the maintenance period of the cooking task a similar intervention was used for the participant's voluntary work.

The results showed an error reduction of 44% in the cooking task and 39% in the voluntary work. The number of corrected errors increased from 4-15% in the baseline period to 25-46% in the maintenance period in the cooking task.

A detailed history of the participant was provided and current neuropsychological functioning was assessed. The rationale for the study was clearly presented, whilst descriptions and referencing provided information for replication. The study was measured by performance on real-life tasks and therefore, for the participant, had good external validity. The graphical representation of the results on the cooking task showed a clear reduction in the frequency of errors. However, the graphical representation of the results from the volunteer work showed a less clear effect. Statistical analysis on these results would have aided more confident interpretation of the results. It is difficult to generalise the results of this study to others as it was a single-case design. However, the methodological quality of the study was good, with the only limitation being the omission of statistical analysis.

Another study that employed an MSI approach – Goal Management Training – was done by Schweizer, Levine, Rewilak, O'Connor, Turner, Alexander et al. (2008). The methodology is in the format of a case study and is therefore classified as a Class IV study. This paper outlines how damage to the cerebellar area of the brain, which has typically been associated with motor functions, can result in difficulties with executive function and attention. The authors state that the goal of their study was to assess the effectiveness of a recognised executive rehabilitation technique in a patient with impairments arising from this region. The participant was a 41-year-old male who was 127 days post injury. Goal Management Training (GMT) uses a five-stage process to train problem solving. Stage 1 involves the use of a phrase such as “STOP” to orientate and assess the current state of progress towards a goal; stage 2 involves defining the main task; Stage 3 involves breaking the task down into smaller steps; during STAGE 4 the participant learns the steps involved in the task; and in STAGE 5 the participant checks their progress against planned goals. The participant was taught these five stages and practiced using them over 7 weekly 2-hour sessions. The efficacy of GMT was assessed with various neuropsychological tests of executive functioning and attention on which there was the potential to use the strategies learned (see Table 2). These tests were performed at baseline (127 days post injury); post rehabilitation (218 days post injury; 48 days post rehabilitation); and at follow-up (322 days post injury).

The results are presented as descriptive information with no statistical analysis.. On two of the tests (R-Sat and Hotel Task) the participant performed at ceiling for all of the items and therefore no improvement was possible. The participant rated himself as having few problems pre and post rehabilitation on the DEX. His spouse, however, also reported no difficulties post rehabilitation – an improvement of 11 points to pre rehabilitation. Scores on the CFQ indicated that the participant was more aware of his difficulties post rehabilitation and at follow-up. There was a reduction in the number of errors on the SART at post rehabilitation and at follow-up. There was only a small improvement on the D-KEFS Tower Test at post rehabilitation and follow-up. Some functional outcomes were also reported. After completing the rehabilitation program the participant was able to return to work on a part-time basis –

after a month he had returned full-time. At follow-up this progress had been maintained and his wife reported no problems.

The methodological quality of this paper is enhanced by the inclusion of a detailed history of the participant and their current neuropsychological functioning. The rationale for the study was clearly presented, whilst descriptions and referencing provided information for replication. However, there was a lack of detail about how the GMT was taught and practiced. Performance on two of the outcome measures was at ceiling when tested at baseline. The results on the remaining measures were mixed with some evidence of improvement following intervention. The use of formal functional outcome measures would have added more information about the impact of the intervention. The real-life gains that are reported are interesting and indicate that there had been significant improvement in the participants functioning. However, there is no way of relating these directly to the intervention described. The participant was only 127 days post injury at the time of the intervention and was therefore more likely to have some spontaneous recovery. In terms of reporting data on an area where there is no literature (i.e. treating dysexecutive problems resulting from cerebellum damage) this paper provides interesting information for future researchers. Nevertheless, it is of limited value to the evidence base for rehabilitation of executive functioning.

In summary, two Class IV studies were reviewed in this section. The methodological quality of the Ownsworth et al. (2006) study is good and it provides evidence for the effectiveness of an MSI approach used in a real-life setting. The single-case design methodology, however does not allow for the results to be generalised. The second paper by Schweizer et al. (2008) was also undertaken on an individual case and provides some evidence for using GMT with a participant experiencing executive problems as a result of injury to the cerebellum area of the brain. Given that both studies were classified as Class IV studies means that neither can contribute to updating recommendations.

Feedback, education, and reasoning

One study in this review used a combination of feedback, education, and reasoning as an intervention. This approach includes feedback about performance on executive functioning type tasks, education around techniques for improving performance, and reasoning in the form of discussions around the rationale for using certain techniques. Kennedy et al. (2006) reviewed three studies that used reasoning to train strategic thinking. The study described below used verbal reasoning but also included feedback and education in its approach.

Satish, Streufert, and Eslinger (2008) used a case study methodology and is therefore classified as Class IV study. The study aimed to assess whether identifying specific deficits in problem-solving functioning after TBI could lead to a more directed and effectual intervention. It did this by using a simulation technology called Strategic Management Simulation (SMS). This presents participants with a number of real-life problem-solving scenarios and asks them to make decisions and solve problems relating to that scenario. The SMS assessment and training system was initially designed to assess, evaluate, and train people in occupational settings. An example simulation scenario is acting as an emergency manager for a local area. Participants are given detailed written and video information and asked to make decisions and take actions, with each scenario taking up to four hours. Performance was measured by nine categories of functioning that contained a total of twenty-five indicators that were calculated by a computer. Table 3 gives a summary of what the categories measured.

Table 3: Summary of performance categories on the SMS assessment and training system

Category	What it measured
Activity level	Different types of activity from the total number of actions to actions that reflect the capacity to utilise previous experience
Speed	Time it takes the participant to undertake actions
Responsiveness	Actions that are responsive to events
Initiative	Activities that demonstrate initiative
Information orientation	How well someone searches and uses the information presented to them
Emergency response	Actions and strategies that deal with problems generated by an emergency
Breadth	The breadth of the actions and strategies applied
Planning	The frequency with which plans are translated into actions
Strategy	Different aspects of strategy application from the complexity of the strategy to the number of actions in a strategy

The participant was a 47-year-old man, 15 months post TBI sustained in a car accident. His neuropsychological test scores placed him in the normal range but his occupational and community skills were reported as problematic. During the assessment phase of the study the participant undertook one of the SMS scenarios. This gave the researchers a detailed breakdown of problem solving functioning. The retraining phase took place in two stages. Stage one included detailed feedback about areas of weakness that the SMS identified; discussion about how these mapped onto real world functioning; generation of alternative strategies and behaviours – initially provided by the trainer but over time generated by the participant. Stage two involved presenting the participant with problem scenarios in the areas of weakness identified. The retraining phase happened on a weekly basis for 3 months. Once the retraining was complete the participant undertook a parallel SMS scenario.

The results showed improvements in scores in the *activity, initiative, a*nd *breadth* categories No formal statistics were undertaken on the results, however the four scores that were considered in the impaired range moved to within the normal range and five scores in the low range also moved to within the normal range. Only one score remained in the low range.

Detailed description of the aims, background information, participant, and procedure are presented in this study. The simulation software used helped to identify specific functioning deficits and these appear to have improved when the participant was tested with a parallel version of the task. Therefore, the aims of the study were achieved. It is not clear however whether the skills learnt will be transferable to real-life functioning. Another possible problem with the study is the length of time it takes to undertake the SMS scenarios, typically four hours, and the complexity of the task. This may not be suitable for many people that have suffered a TBI. However, in-depth analysis of functioning in simulated real-life situations may provide important information for rehabilitation professionals.

In summary, one Class IV study was reviewed in this section. In relation to case study designs the methodological quality of the study is good and it provides evidence for the effectiveness of an approach that uses feedback, education, and reasoning. The case study design however, does not allow for the results to be generalised or for the effect be attributed to the intervention and it cannot add to the evidence base. However, the paper does provide a description of an intervention that has not been used on people with TBI, and therefore provides an interesting area for future research. Future research could control for threats to validity such as spontaneous recovery, severity of injury, and the equivalence of the parallel test.

Combined MSI and feedback, education, and reasoning approach

One paper in this review used a combination of MSI and feedback, education and reasoning. Ownsworth, Fleming, Shum, Kuipers, and Strong (2008) compared three interventions for improving functional and occupational performance and facilitating goal attainment following TBI: a group-based programme that used feedback, education and reasoning; an individual occupation-based intervention using an MSI approach; and an intervention that combined both the group and individual intervention. The study used a RCT methodology and has been classified as a Class I study. Thirty-five participants took part in the study. The design incorporated a waiting list group control group who were also then randomly allocated to one of the three intervention groups. The results from the treatment groups therefore included participants that had also acted as controls. There were 10 participants in the individual intervention, 11 in the group intervention, and 10 in the combined intervention. The waiting list group contained 17 participants. Four participants withdrew from the study. The group-based intervention targeted the development of compensatory strategies and self-awareness through peer and facilitator feedback, education, goal setting, support with developing strategies, discussion about strategy use and strategy practice during the group. It ran for 3 hours a week for 8 weeks. The individual occupation-based intervention was based on the MSI intervention outlined in the Ownsworth et al. (2006) study described above. This intervention also ran for 3 hours a week over 8 weeks. The final intervention was a combination of the group-based intervention and the individual intervention. It contained the same amount of therapy time as the individual and group interventions (1.5 hours in a group and 1.5 hours of the individual intervention per week) with similar content condensed to fit into the timescale. The outcome was measured with the Canadian Occupational Performance Measure (COPM), which gave a measure of improvement in individualised goals; the Patient

Competency Rating Scale (PCRS), which was used to measure behavioural competency; and 3 scales from The Brain Injury Community Rehabilitation Outcome 39 (BI-CRO-39), which gave a measure of psychological well-being, socialisation and productivity.

The main findings of this study were mixed. There were significant improvements in self and relative COPM ratings of performance and satisfaction pre and post assessment after both the combined and individual interventions ($p<0.05$) but not after the group intervention. The common type of intervention in these two conditions is the MSI approach. Improvements in behavioural competency (as measured by the PCRS) were observed for the group intervention when rated by the participant and for the individual intervention when rated by the relative. The combined intervention did not improve PCRS scores for either participant or relative. It is possible that this set of results indicates improvements that relate to the single therapy setting of the group and individual interventions. The reduction in individual and group therapy required to make the combined intervention the same length of time as the other interventions may have reduced their overall efficacy. In relation to the differences in COPM scores across interventions it is possible that because the COPM measures individualised goals and the individual and combined interventions contain a more individualised approach, the COPM is better suited to measuring this intervention. Improvements in psychological well-being (as measured by the BI-CRO-39) were only observed for the group intervention. This suggests positive aspects of the group intervention such as peer support and feedback. There was no change in the other BI-CRO-39 scales across all conditions. There was also no change for the waiting list controls on any of the outcome measures.

This study is of good methodological quality. The demographic variables and the rationale are explained clearly. The waiting-list design allowed the researchers to avoid the ethical considerations of having a no-treatment group, and the interventions were described clearly, with references provided to aid replication. However, there are some limitations. The whole sample had a range of time since injury of between 2 and 18 years. This heterogeneity could have impacted on aspects of the results as people nearer to their time of injury are more likely to spontaneously recover. The sizes of the groups compared were relatively small and this may have led to some Type II errors on some of the measures, specifically the group intervention COPM ratings appeared to be approaching significance. A final methodological consideration is the outcome measures, which were all subjective self and relative rated tools. The inclusion of more objective measures of performance on task, would have decreased the risk of bias.

In summary, one Class I study was reviewed in this section. The methodological quality of the Ownsworth et al. (2008) study is good. An advantage of the study is that it compares different types of interventions for the rehabilitation of executive functioning. The conclusions of the paper are not clear and more research is needed to ascertain the impacts of the different interventions. However, the individual intervention did have more consistent results than both the group and combined intervention. The paper is let down by the use of subjective outcome measures but can still be used to update the evidence base.

Using analogy / previous experience to solve problems

Three studies in this review have described interventions that use analogy or previous experiences to help solve problems. This appears to be a new intervention technique.

Hewitt, Evans, and Dritsche (2006) attempted to train participants to use previous experiences to help solve current problems in a RCT that has been classified as a Class I paper. Based on Shallice's (1982) model of the Supervisory Attention System (SAS) they argue that retrieval of episodic memories involving experiences of solving similar problems is an important stage in planning and problem solving. There were two groups of 15 participants with TBI. There were three phases to the research. In phase 1 both groups undertook the Everyday Descriptions Task. This consists of two sets of eight questions that require participants to describe how they would plan certain activities, for example "how would you organise a move to a new place to live?" During phase 2 each group undertook a series of neuropsychological tests that included executive functioning, attention and memory. Group 1 then had a 30-minute break, whilst group 2 were given training that followed a detailed protocol. This involved informing the participants that research has shown that using memories can help people to plan activities. Examples were given and participants were asked to find their own examples. During phase 3, both groups were given a second set of questions from the Everyday Descriptions Task. A cue card was placed in front of only group 2 that read "try to think of a specific time and place where you carried out a similar activity in the past". All three phases took between 60 and 90 minutes. A trained rater who was blind to group membership rated the responses of each participant. Ratings were obtained for (1) effectiveness of the plan (2) number of steps and (3) number of specific memories used.

The results showed that the intervention was successful in improving the effectiveness of the plan and the number of steps in the plan ($p<0.01$). They also showed that there was a positive correlation between the number of memories recalled and effectiveness of plan and number of steps in the plan ($p<0.01$). These results support the claims by the authors that finding solutions to novel problems may benefit from recollection of previous experiences of solving similar problems.

The study was well-controlled, with a carefully selected and matched sample. The groups did not significantly differ on their neuropsychological test profiles which allowed the authors to have confidence that treatment effects were not due to these possible confounding factors.

Soong, Sing-Fai Tam, Wai-Kwong Man, and Hui-Chan (2005) randomly allocated 15 participants (from an original pool of 83 drawn by lot from services in Hong Kong) to one of three versions of an analogy problem-solving skills programme. Unfortunately, there was no control group (i.e. no untreated group), an expectation of a Class I study, or independent assessment of outcome, an expectation of Class I, II, and III studies, it was therefore classified as a Class IV study. The three interventions were based on an analogical problem-solving skills training approach developed by Halpern, Hansen and Riefer (1990). Participants were trained over 20 sessions in various problem-solving skills through the use of analogies. A source problem was presented that required the participant to solve a particular type of problem (e.g. convergent feature analysis – identifying common features of things; or convergent inference – inferring what is being described). The participants were then given illustrative examples and typical solutions to help solve the problems. Finally a target problem, similar in structure to the source problem, was given to the participant, who was encouraged to draw analogies with from previous problem-solving experiences to solve the new problem. The three versions of the training programme were identical but differed in the way that they were delivered. The computer-assisted skill-training programme (CCRG) involved interactive multimedia presentations. The training also used a therapist who provided support if required. The online interactive computer-assisted skill-training programme (OCRG) involved real-time computer-assisted support from a remote therapist. The therapist-administered training programme (TCRG) consisted of face-to-face therapist administered training, which included demonstration, role-play, coaching and performance feedback. The outcomes were measured using the Lawton Instrumental Activities of Daily Living Scale (IADL), a measure that assesses independent living skills; the Category Test of Halstead-Reitan Test Battery (HRTB), a test of problem solving skills, logical analysis, concept formation, abstract reasoning and mental efficiency; and a self-efficacy checklist.

The results showed that there were significant differences between pre and post measures on the Lawton IADL and the Category Test ($p<0.00$) across all conditions but no significant differences on the self-efficacy checklists. This indicates that there was an improvement post intervention regardless of how it was delivered but it did not impact on the participants' perceptions of their confidence in their own ability.

There are number of limitations to this study. The absence of a no-treatment control group makes it hard to attribute the effect to the intervention and improvement could be accounted for by spontaneous recovery. The outcome measures were administered by members of the research team and are therefore prone to biases such as participants aiming to please the researchers. The self-efficacy checklist was poorly described and appears to be a checklist devised by the researchers, suggesting untested validity and reliability. No neuropsychological tests were undertaken and it is therefore difficult to assess the exact level of impairment and heterogeneity of the sample. Severity of the brain injury is not given which limits the understanding about who the intervention may be suitable for. This study is therefore open to a number of possible flaws. For this reason it provides limited evidence for the rehabilitation of executive functioning.

Man, Soong, Tam, and Hui-Chan (2006) also used an analogy-based problem solving technique. This used a RCT design but as there was no independent assessment of outcome, an expectation of Class I, II, and III studies; it was classified as a Class IV study. The authors assert that poor problem-solving after TBI may be due to the break down of systematic intellectual processes, such as analogical problem solving i.e. the ability to transfer problem-solving knowledge gained in other situations to new contexts. The aim of the research was therefore to evaluate a pictorial based analogical problem-solving training programme. The study consisted of an experimental group (n=30) and a no-treatment control group. Participants were screened with various neuropsychological tests for differences in arousal, attention and memory. The untreated control group were age and gender matched. The training programme was developed from previous studies on analogical problem-solving skills. Over 18 weeks participants were given training in a number of different problem-solving skills (e.g. convergent and divergent problem solving). They were presented with a source problem, for example describing the possible outcomes to certain situations and given guidance about how to solve it. These problems were also presented in pictorial form. The subjects were then encouraged to draw analogies from the source problem to solve new problems. The participant's answers to these new, target problems were part of the outcome measure. The other outcome measures were the Category Test for adults from the Halstead-Reitan neuropsychological test battery. This is a test of problem solving skills, logical analysis, concept formation, abstract reasoning and mental efficiency. The Hong Kong Chinese version of the Lawton instrumental activities of daily living scale (Lawton IADL) was also used. This assesses competence in behaviours such as shopping and laundry. It was assumed that people with better problem-solving skills would demonstrate higher functional independence when performing daily living activities.

The results showed that the participants had statistically significant improvements in several of the skills (e.g. sequential classification, comparison-contrast, identifying effects and solutions) and also on the Category Test and Lawton IADL. The control group did not show significant improvement in the Category Test or the Lawton IADL. The control group also undertook some problem quizzes, which they did not improve on.

This paper provides some tentative evidence in the use of an analogical problem-solving training programme for improving problem-solving skills in people with TBI. However, several methodological weaknesses undermine this paper. There is no evidence of independent assessment of outcome. Additionally, examination of the means on the Lawton IADL for the control group pre and post testing show that they were very similar to the experimental groups pre and post testing means. However, the experimental group reached significance whilst the control group didn’t. Therefore, the smaller numbers of participants in the control group may have affected the power and led to the lack of statistical significance found. The training programme was poorly described and it was unclear exactly how each of the sessions was undertaken. The problem quizzes that each group undertook as outcome measures differed and it was unclear how they differed. The use of the pictures in the training is not explained. This study therefore provides limited evidence for the effectiveness of this type of intervention for rehabilitation of executive functioning.

In summary, one Class I study and two Class IV studies were reviewed in this section. The Class I study by Hewitt et al. (2006), provides evidence for the effectiveness of using previous experiences to aid planning. The two Class IV studies had several methodological weaknesses. As studies describing new interventions they are interesting for future researchers but cannot be used to update recommendations.

Discussion

A total of seven studies were included in this review. Evidence was found from the two Class I studies (Hewitt et al., 2006; Ownsworth et al., 2008) that supported the use of MSI approaches and an approach that uses previous experiences to aid planning. The Class IV studies (Man et al., 2006; Ownsworth et al., 2006; Satish et al., 2008; Schweizer et al., 2008; Soong et al., 2005).varied in their methodological quality and due to their designs cannot be used in updating recommendations. However, Ownsworth et al. (2006) in a single-case experimental design demonstrated positive results in the use of an MSI approach in an occupational setting; Satish et al. (2008) outlined an interesting intervention technique based on a simulation computer programme, which also provided positive results based on a case study; Schweizer et al. (2008), also a case study, reported some evidence for the use of an MSI approach (Goal Management Training) with a person who had suffered damage to the cerebellar area of the brain; Soong et al. (2005) assessed three versions of an analogical problem solving training programme, each of which appeared to improve problem-solving skills; and Man et al. (2006) assessed an analogical problem-solving training programme against a control group, finding evidence for improvement in problem-solving skills.

Population sample characteristics

All of the participants from the studies were young to middle aged adults. Most of the studies used participants who were at least two years post injury. Exceptions included Schweizer et al. (2006) who used a subject who was six months post-injury and Man et al. (2006) who used some subjects who would have been around 6 months post-injury. The control group in the Man et al. study (2006) also contained some subjects around 6 months post-injury, which would have provided some control for spontaneous recovery. No studies used children or older adults. All of the group based studies detailed inclusion and exclusion criteria but none of the individual cases did. However, as would be expected the case studies provided more detailed information about their participants. Evidence of severity was provided in five of the seven studies (Hewitt et al., 2006; Ownsworth et al., 2006; Ownsworth et al., 2008; Satish et al., 2008; Schweizer et al., 2008) by either, Glasgow Coma Scale scores or length of post-traumatic amnesia. The individual case studies again provided more details about injury severity. All but two of the studies (Ownsworth et al., 2008; Soong et al., 2005) undertook neuropsychological testing to determine the cognitive functioning of their participants. However, only one study specifically screened participants for executive functioning difficulties prior to intervention (Ownsworth et al., 2006). This could have impacted on subsequent results as participants without specific deficits in executive functioning may perform better following intervention than participants with executive functioning deficits. Features of the studies that were less well reported included treatment history, post-injury living situation, motor functioning, and pre-morbid characteristics. In general, however the studies reviewed provided sufficient participant information for the studies to be replicated.

Study designs and intervention

One of the main methodological considerations in assessing a study's strength is the amount of control that the design has over possible confounding variables. An RCT is considered the best design for controlling biases in research. However, an RCT can have different levels of control over variables and using the AAN guidelines (Edlund et al., 2004) this means that not all RCTs are classified as Class I studies. A requirement of a Class I, II, III study in the AAN guidelines (Edlund et al., 2004) is for independent assessment of outcome. Two of the RCT designs did not include this and were therefore classified as Class IV studies (Man et al., 2006; Soong et al., 2005). The issue of blinding is problematic when reviewing studies of therapeutic interventions. The blinding of participants and the therapists to the treatment is impractical during therapeutic interventions and this increased the possibility of biases around positive treatment expectations and the desire to please. Another requirement is the inclusion of a control group, and one of the RCT designs did not include this (Soong et al., 2005). These flaws in the designs are regrettable, as both studies could have provided Class I evidence given more control. According to the AAN guidelines (Edlund et al., 2006) the three individual case studies require a Class IV classification and cannot provide evidence for recommendations. However, one of the studies used single-case design methodology which uses a baseline control condition and is therefore more methodologically rigorous.

As mentioned above the interventions used fell into three categories – interventions that used MSI approaches; feedback, education and reasoning approaches; or using previous experience / analogies to solve problems. Four of the studies had the goal of improving problem-solving skills to aid functional abilities (Man et al., 2006; Ownsworth et al., 2006; Ownsworth et al., 2008; Soong et al., 2005); one of improving planning skills for everyday tasks (Hewitt et al., 2006); one concentrated on the management of goals whilst undertaking everyday tasks (Schweizer et al., 2008); and one on improving problem-solving abilities during complex tasks (Satish et al., 2008). Each of the interventions provided either enough detail or references to allow replication. This detail included the amount of time and frequency of the intervention, and the level of support provided.

All of the studies reviewed demonstrated some improvements in the outcome measures after intervention. Four of the studies improved the functional skills of participants, two demonstrated improvements in functioning and performance on neuropsychological tests, and one neuropsychological tests alone. Studies improving functional ability are perhaps more valuable to rehabilitation professionals due to the sometimes moderate association between performance on neuropsychological tests and everyday functioning (Burgess, Alderman, Evans, Emslie, & Wilson, 1998).

Strengths and limitations

There are two main strengths of the research reviewed above. Four of the seven studies were on interventions that had not been tested on participants with brain injury. These studies provide the evidence base with crucial new areas for investigation and cited some promising results. Another strength of the studies is the use of interventions that can be used to tackle everyday functional problems. Most of the studies included some aspect of real-life problem solving and were designed to be useful and transferable.

The main limitation of the research is the paucity of new studies since the last review was undertaken in 2005. Kennedy et al. (2008) noted how much more needs to be known about interventions for executive functioning and this continues to be the case. Another limitation was the design flaws in two of the RCT studies that did not allow them to be included in any recommendations. With limited evidence available it is crucial to design and implement studies that can add to the evidence base. Case studies and single case designs can be built on with group studies and are useful in determining future areas for research. The length of time the interventions took is also a possible limitation of these studies. Five of the seven studies had interventions that were over 10 sessions long and this would potentially be difficult for professionals to undertake. A final limitation of the research is the general deficiency of information about generalisation to other areas of functioning and long-term maintenance of the interventions described.

Update of Recommendations

As mentioned only the two Class I studies in this review can be used to update the recommendations. Kennedy et al. (2006) recommended the use of step-by-step MSI approaches with young to middle aged adults. The Ownsworth et al. (2008) study, which used an MSI approach in an individual intervention as well as in a group-based intervention, provides further support for this approach. This evidence combined with the Kennedy et al. (2008) review allows for this intervention to be classified as a class A recommendation which "*should be done*". The studies varied in the amount of intervention required, however the common steps in each were: acknowledging / generating goals; self-monitoring and self-recording of performance; and strategy decisions based on the performance-goal comparison in which plans and actions are adjusted accordingly.

The second Class I study reviewed by Hewitt et al. (2006) provided positive results for the use of an intervention that trained participants to use past experiences to help them plan how to solve new problems. This approach highlighted to participants how past experiences can help solve new problems through the use of therapist provided examples and practice. A cueing procedure was then used to remind participants to draw on past experiences when they were presented with new problems to plan. This intervention was undertaken on young and middle aged adults. The AAN guidelines (Edlund et al., 2004) state that one good quality Class I study can be used for Class B recommendations. Therefore, for young to middle aged adults with TBI using past experiences to help plan the steps involved in new problems *"should be considered"*.

The studies that could not be used in updating the recommendations provide some potential areas for future research. These areas include the use of analogies to aid problem-solving, the use of computer generated simulations of real-life situations to learn problem-solving skills, and using GMT to treat executive problems resulting from cerebellum damage.

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Empirical Paper

The effect of Visual and Verbal Feedback on Self-Awareness: An Application of SenseCam

Prepared for submission to Neuropsychological Rehabilitation

Abstract

Purpose: To compare the effects of verbal and visual/verbal feedback on awareness of errors and performance on a planning test. Visual/verbal feedback was recorded using SenseCam.

Method: Eighteen participants were allocated to one of two groups – visual or visual/verbal feedback. Participants undertook a planning test, gave ratings on awareness of errors, received feedback on performance, undertook the test again, and then gave ratings a second time. Ratings of awareness were obtained generally and in relation to specific error categories of the test.

Results: No significant improvement between the groups in general awareness of errors was observed. Awareness of specific error categories improved for the visual/verbal group significantly more than the verbal group. The visual/verbal group also improved their performance significantly more than the verbal group. Results were subject to a confound variable that limited conclusions that could be drawn. The visual/verbal group's initial awareness after asking about specific errors was significantly lower than the verbal group's.

Conclusions: Visual/verbal feedback improved awareness of specific errors and performance significantly more than verbal feedback. The confound variable limited conclusions that could be drawn. Results suggested that participants' reporting of errors was more accurate after questioning was broken down to specific levels.

Introduction

Brain injury can impact on all areas of a person's life, creating deficits in physical, cognitive, emotional and social functioning. Impairments in awareness of these deficits can have a number of wide-ranging implications. These include increased likelihood to be referred for more intensive post-acute rehabilitation (Malec & Degiorgio, 2002); poor compliance and participation in treatment (Lam, McMahon, Priddy, & Gehred-Schultz, 1998); longer stays in post-acute rehabilitation (Malec, Buffington, Moessner, & Degiorgio, 2000); poorer functional status at discharge from acute inpatient rehabilitation (Sherer et al., 2003); and poorer employment outcomes (Sherer, Bergloff et al., 1998).

Awareness, or self-awareness as it is commonly referred to, has been defined as "the capacity to perceive the 'self' in relatively 'objective' terms while maintaining a sense of subjectivity" (Prigatano & Schacter, 1991, p. 13). After a brain injury a person will go through a period during which they acquire an understanding of their impairment and the impact of this upon their day-to-day functioning. Various models have been proposed that explain how awareness of deficit is acquired, and for those who fail to gain it, why this might happen. Neuropsychological models highlight various regions of the brain or propose modular cognitive systems that might be involved in self-awareness (e.g. Bisiach, Valler, Perani, Papagno, & Berti, 1986; Crosson et al., 1989; McGlynn & Schacter, 1989; Schacter, 1990; Stuss & Levin, 2002). Other models incorporate more psychological, emotional, social, and cultural aspects of adjusting to impairment and their impact on self-awareness (e.g. Clare, 2004; Toglia & Kirk, 2000).

The neuropsychological models suggest various cognitive processes that contribute to unawareness including the executive system (Schacter, 1990; Stuss & Levin, 2002) and long term memory (Agnew & Morris, 1998). The latter model proposes that performance information e.g. the knowledge that an error has been made, enters long-term autobiographical memory, this information is then consciously experienced by a conscious awareness system (CAS) and at the same time it passes into a 'comparator mechanism' located in the central executive system. This cognitive mechanism compares the information about current performance with a 'personal knowledge base' (PKB) of past ability that is held in semantic memory. If there is a mismatch between current performance and past performance, the PKB is updated, and this information enters conscious awareness. The updated PKB then allows the person to make changes to their behaviour or expectations.

Thus, according to this model, providing feedback in the form of autobiographical information about errors could impact on self-awareness, behaviour and expectations by facilitating encoding and thus increasing the amount of information available to compare current and past performance. This process is the focus of this research.

Various interventions for rehabilitating self-awareness following brain injury have been researched, including the use of feedback, education, psychotherapy, and a therapeutic milieu (e.g. see Beiman-Copeland & Dywan, 2000; Crosson et al., 1989; Mateer, 1999; Prigatano, 1999; Sherer, Bergloff et al., 1998). Reviews in this area by Sherer (2005) and Fleming and Ownsworth (2006) both recommend the use of feedback in the rehabilitation of self-awareness. Fleming and Ownsworth (2006, p.492) assert that when self-awareness deficits are due to the cognitive consequences of brain injury, interventions should include "clear feedback and structured opportunities to help people to evaluate their performance, discover errors, and compensate for deficits”.

The reviews highlight eight studies involving the use of feedback to improve performance / awareness in people with acquired brain injury. Three studies (Redmann & Hannon, 1995; Sclund, 1999; Youngjohn & Altman, 1989 cited in Sherer, 2005) involved giving people feedback on their accuracy of estimating their own performance on a memory and maths task, and found that all participants improved their estimates of performance. However, task performance was not consistently measured and generalisation was not tested. Five studies explored the effect of direct feedback involving online therapist feedback or audiovisual feedback: one of these studies (Katz, Fleming, Keren, Lightbody, Hartman-Maeir, 2002 cited in Sherer, 2005) used verbal feedback and showed improvement in functional skills but no change in awareness; four used video feedback, two of which (Alexy, Foster, & Baker, 1983; Liu, Chan, Lee, Li, & Hui-Chan, 2002) were case study descriptions only, and suggested some benefits. The remaining two studies (Tham, Ginsburg, Fisher, & Tegner, 2001; Tham & Tegner, 1997) were on people with visual-spatial neglect and involved presentation of neglected items to the non-neglected side using video feedback. Both these demonstrated improvements in performance whilst Tham et el., (2001) also demonstrated improvements in awareness.

Therefore, no studies have directly compared the use of verbal and visual/verbal feedback. The focus of the present research is to explore whether feedback utilising photographic images will improve self-awareness more than verbal feedback alone. Evidence and theory is presented below that argues for the advantages of using imagery to improve memory. It is suggested that improving memory of performance on tasks, will lead to improvements in self-awareness of performance and actual performance on future tasks.

Evidence for the superiority of visual encoding can be found in a series of studies by Standing (1973) who found that participants could remember around 90% of a sequence of 2500 pictures presented to them 36 hours previously. This level of remembering is far higher than the memory for words tested in a comparable way (e.g. see Borges, Stepnowsky, & Holt, 1977). Furthermore, Paivio (2007), argues for a dual-coding theory of information processing, involving separate but interconnected verbal and visual memory systems. Memory for visual information is thought to be superior to verbal information, because it is encoded into both the visual and verbal memory systems. Verbal information, however, is thought to be encoded primarily, but not entirely, by the verbal system. The systems responsible for both of these processes are thought to be additive; therefore memory can be improved by using both verbal and visual information.

Feedback based on personalised images may also be processed at a deeper level than just verbal feedback. Support for this comes from the levels of processing theory of memory (Craik & Lockhart, 1972). This suggests that information is better recalled if it is processed at a deeper level i.e. if meaning is processed, rather than simply how it looks or sounds. In the present study, feedback in one condition is supplemented by visual images recorded as participants undertake a task and it is possible that this information is more meaningful (and hence feedback is more likely to be encoded) because the information is personalised. The person can see the context of their errors – see them happening, observe other things happening around them, and make new associations.

A qualitative study by Dirette (2002) emphasises the importance of personal, real life experiences in promoting self-awareness. This study found that participants were more likely to update their knowledge of themselves if the experience was gained in their own environment rather than in the rehabilitation centre. A series of ‘aha’ moments are described, that were personally relevant and meaningful and had a particular impact in their process of attaining self-awareness of deficits.

Lastly, there is a consensus in the research and theoretical literature that autobiographical memory (i.e. memory of personal experiences) is largely made up of visual imagery (see Conway, 1996; Conway & Fthenaki, 2000). For example, Brewer (1988) found that more than 80% of randomly sampled memories consisted of visual images. Providing feedback in the form of images may therefore be more consistent with the way autobiographical memories are stored and improve the coding, retention, and recall of this material.

A new wearable camera developed by Microsoft called SenseCam (Hodges et al., 2006) will provide the image feedback in the research. It is worn around the neck and takes pictures from a first-person perspective. These are taken when there are certain changes in the environment, such as changes in light or sound, or at specific time intervals, for example every 10 seconds. The pictures can then be reviewed one by one or in a ‘movie’ sequence. SenseCam has some unique attributes that may be of interest to rehabilitation professionals. It is small and therefore discreet when being worn. The pictures are taken passively, allowing the person wearing the camera to go about their activities without having to stop. It can produce a large number of pictures (over 2000 in a day is possible) from a first-person perspective. This produces a unique pictorial diary of an event or a whole day. The design of SenseCam incorporates a wide-angle lens that produces images thought to closely represent the actual images seen by the wearer.

Research with SenseCam is in its early stages. A case study by Berry et al., (2007) compared two memory aids – SenseCam and a written diary, on a participant with severe memory impairment. Results showed that the participant recalled 80% of personal autobiographical events when using SenseCam, and only 49% when using a written diary. The SenseCam events were also shown to be retained 11 months after the event took place. In a recent extension of this research Berry et al. (2009) compared the same participant's recognition of SenseCam images taken on four comparable autobiographical events. They found that the participant recognized 90% of images from the event when the images were reviewed, compared to 56% of the images of the event when only a written diary was reviewed ($p<0.001$). They also found that the participant did not recognize 75% of images from an event that wasn't reviewed by image or diary, or 75% of images from an event that was undertaken by someone else. Whilst being asked to recognize the images the participant's brain activity was assessed using an fMRI scanner. When the images from the different events were compared SenseCam reviewed images produced more activity in the frontal and posterior cortical regions of the brain. These regions have been associated with normal episodic memory functioning (e.g. see Cabeza & St. Jacques, 2007).

This early research suggests that SenseCam is successful in assisting with either encoding and /or activating recall of autobiographical memories. If this is the case then SenseCam may also be successful in improving self-awareness.

In summary, the aim of this study is to further explore the use of feedback in facilitating self-awareness. Two forms of feedback will be assessed: (i) first person based images and verbal description and (ii) verbal description alone. This will involve participants undertaking a planning and multi-tasking test, giving ratings of how well they think they have done, receiving feedback on performance according to one of two conditions, undertaking the test again, and then giving ratings of how well they think they have done for a second time. An executive functioning test, the Multiple Errands Test – Hospital Version (MET-HV) (Knight, Alderman, & Burgess, 2002) was chosen for the study as it provides a previously controlled test that has ecological validity and known psychometric properties.

The participants will be asked about two types of self-awareness of errors: (i) self-awareness of errors in general – i.e. how many errors they thought they made in total and (ii) self-awareness of specific errors – i.e. how many they thought they made in each of the error categories from the MET-HV (see below for description of error categories). For the sake of clarity, in the remainder of the document (i) will be referred to as 'general self-awareness' and (ii) as 'specific self-awareness'. Both of these questions were asked as there is evidence that people with a brain injury are more likely to admit to deficits in functioning when they are asked about specific areas compared to when being asked about general areas (Sherer, Boake et al., 1998). Sherer et al (1998) argue that general questions may be more cognitively demanding, and are therefore more difficult to answer.

Hypotheses for the study are as follows:

- Hypothesis 1: Visual/verbal feedback will be superior to verbal feedback alone in improving general self-awareness of errors made on the MET-HV (see data collection points 1a and 1b on figure 1)
- Hypothesis 2: Visual / verbal feedback will be superior to verbal feedback alone in improving specific self-awareness of errors made on the MET-HV (see data point 2a and 2b, figure 1)
- Hypothesis 3: Visual / verbal feedback will be superior to verbal feedback alone in improving performance on the MET-HV as measured by total number of errors (see data collection points 3a and 3b on figure 1)

Methodology

Design

This was a mixed within and between subjects experimental design with 2 between subjects levels (visual/verbal feedback vs. verbal feedback alone) and 2 within subjects levels (pre vs. post treatment).

Participants

Participants were recruited from the Kemsley Division, of St Andrews Hospital, Northampton. Full ethical approval was obtained from the Leicestershire, Northamptonshire & Rutland Research Ethics Committee.

Inclusion criteria were:

a) Diagnosis of severe brain injury as indicated in medical notes

b) Aged over 18 years of age

c) English speaking (some of the assessments that were used had only been validated with English speaking participants)

d) A pre-morbid IQ above 70, as measured by the Weschler Test of Adult Reading

e) A score in impaired range on the Multiple Errands Test – Hospital Version (see below for description), suggesting the presence of executive problems and ensuring that participants could potentially improve their performance and awareness of errors when undertaking it for a second time

f) Permission from Responsible Medical Officer to take leave off the ward

The exclusion criteria were:

a) Gross language impairments
b) Inability to maintain behavioral control adequately for a 60 minute testing session (determined by Responsible Medical Officer)
c) People unable to give informed consent (determined by Responsible Medical Officer)

A power analysis was conducted, which suggested that 11 participants would be required in each group.

A total 87 patients were admitted to Kemsley Division during the course of the research. Of these 32 met the inclusion and exclusion criteria. All of these people were approached to see if they would like to take part in the research – 20 people agreed. Two participants dropped out of the research after undertaking the first Multiple Errands Test – Hospital Version. Both of these participants asked to stop after being given feedback and appeared to be agitated by the feedback. A total of 18 participants completed the research.

Participants were randomly allocated to one of two groups, verbal or visual/verbal, using a predetermined randomly generated list of 1s and 2s. The verbal group contained six males and three females; mean age = 35.56 (S.D. = 12.14); mean time since injury = 11.59 years (S.D. = 6.49). The visual/verbal group contained seven males and two females; mean age = 38.00 (S.D. = 10.90); mean time since injury = 14.60 years (S.D. = 9.29). There were no significant differences between the groups on any of these variables (see table 1).

All participants with traumatic brain injury had a diagnosis of severe head injury according to their medical notes, however this could not be confirmed objectively by length of post-traumatic amnesia or Glasgow Coma Scale scores as this information was not recorded in most notes. The breakdown of how the participants obtained their brain injuries is as follows: verbal group – 5 road traffic accidents; 1 assault; 1 fall; and 2 anoxic injuries; visual/verbal group – 6 road traffic accidents; 1 brain aneurysm; and 2 anoxic injuries.

Measures

Neuropsychological tests

A series of neuropsychological tests were undertaken in order to demonstrate the level of cognitive impairment in each experimental group and also because injury related variables (e.g. severity of traumatic brain injury and location of lesion) were often not available.

- Wechsler Test of Adult Reading (WTAR) (Wechsler, 2001) – this was used as test of premorbid intellectual functioning. Participants are required to read a series of 50 increasingly difficult words. This aims to assess learning of these words prior to head injury.
- Prospective Memory items from the Rivermead Behavioural Memory Test-II (Wilson, Cockbury, & Baddeley, 2003) – this was administered as a test of prospective memory. The items used asked participants to remember to do two things in the future – ask when their next appointment was and ask for a personal belonging back which had been placed out of sight.
- Word List I and II and Visual Reproduction I and II from the Weschler Memory Scale-III (WMS-III) (Wechsler, 1997). These tests were used as a measure of verbal and visual memory. During Word List I and II participants are read a list of 12 words

on four separate occasions. After each occasion they are asked to recall as many as they can remember. After a period of 25 minutes the participants are asked to recall these words again and also to recognize any from a list of 24 words. Visual Reproduction I and II requires participants to draw five object designs from memory after they have been presented to them for 10 seconds. They are then asked to draw them again from memory after 25 minutes and recognize any from a set of 48 designs.

Other tests

- The Dysexecutive questionnaire (DEX), from the Behavioural Assessment of the Dysexecutive Syndrome (Wilson, Alderman, Burgess, Emslie, & Evans, 1996) – this questionnaire was used as a measure of self-awareness. This is a 20-item symptom checklist which both the participant and a significant other complete. Discrepancy between self and other total scores was used to assess whether the groups differed in their levels of self-awareness of difficulties.

Main task

- Multiple Errands Test – Hospital Version (MET−HV) (Knight et al., 2002) – see below for description.

Apparatus

- SenseCam – is a portable camera worn around the neck of participants that takes pictures every 5-10 seconds, or in response to changes in the environment, such as changes in light or sound. Wide-angle lens captures images of scene directly in front of participant.

Description of the Multiple Errands Test – Hospital Version (MET-HV)

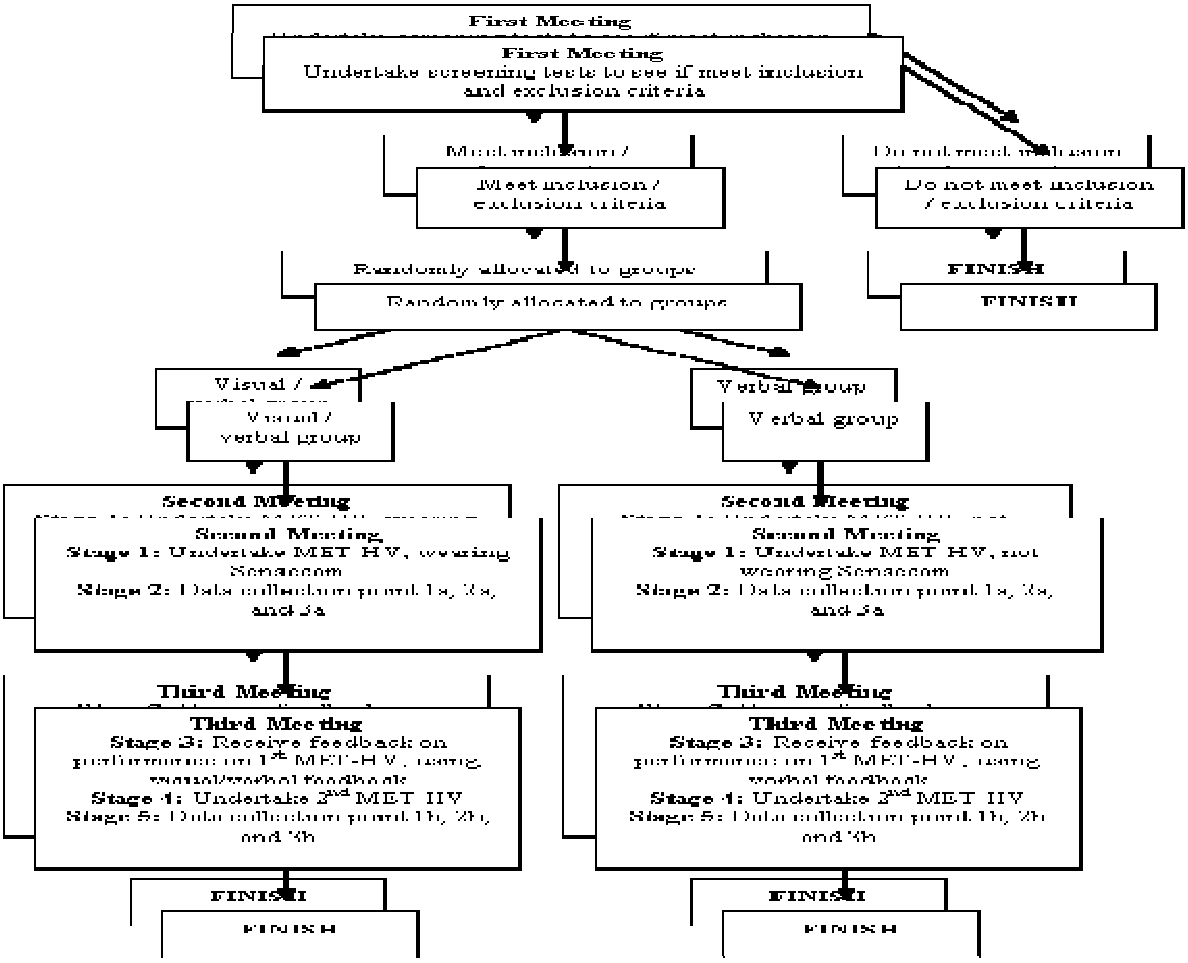
This test was used as both a screening instrument and as the main task for the study. The MET-HV is a planning and multi-tasking test which was developed by Knight, Alderman and Burgess (2002) (see Appendix 4 for a copy of the participant instructions). It is a simplified version of the procedure described by Shallice and Burgess (1991) where participants are required to undertake four sets of tasks, totaling 12 subtasks in all. The first task asks participants to do six specific things – purchase three items, collect an envelope from the main hospital reception, telephone the brain injury unit reception, and post an envelope. The second requires participants to obtain and write down four pieces of information – the opening times of the hospital shop and library, the number of car parks in the hospital, and the price of a Mars bar. The third task asks the participant to meet the examiner outside the main hospital reception 20 minutes after the start of the test and tell them the time. The final task requires the participant to tell the examiner when they have finished the test. The participants were also required to follow nine rules. These included not speaking to the examiner unless it was part of the test, not going into a building more than once, and not buying more than two items from the hospital shop (see Appendix 4 for the full list).

Knight et al. (2002) reported various psychometric properties of MET-HV. Inter-rater reliability for each of the error categories was good, ranging from .81 for interpretation failures to 1.00 for rule breaks. Cronbach's alpha was used to test the reliability of each item of the MET-HV to predict total error score. Internal consistency was satisfactory at .77. Test-retest reliability was not specifically tested. However, Knight (1999) compared the scores of 10 neurologically healthy participants who were tested twice using the MET-HV: once in the grounds of St Andrew's Hospital and once within the local general hospital. A high correlation (.83) between overall error scores from each of the two hospital sites was found. The validity of the MET-HV was tested against other executive functioning tests, with a mixture of significant and non-significant correlations found. Tests with significant correlations included the Behavioural Assessment Dysexecutive Syndrome (BADS), the Elevator Test, and the Card Sorting Test.

Procedure

The participants that met the inclusion and exclusion criteria undertook five stages of the study over two meetings. The data was collected by two researchers – the main researcher (first author) and a research assistant (fourth author). To ensure that the data was collected in equivalent ways the main researcher spent a number of hours training the research assistant to collect the data. This included detailed discussion about the research, explanation of the forms involved, observation of the main researcher collecting data, observation of the research assistant collecting data, and the provision of feedback. All of the feedback for the study was prepared by the main researcher (see description below). Figure 1 shows the different stages and data collection points involved in data collection. A description of the five data collection stages is provided below.

Figure 1: Data collection stages



<u>Stage 1</u>

Participants were firstly asked how well they knew the hospital grounds so that this variable could be compared between groups. This was measured using a fourpoint scale (0 = not at all, 1 = somewhat, 2 = fairly well, 3 = very well). The participants were then given a copy of the participant instructions on a clip board, a plastic bag, and £5. A watch was also given to the participant if they were not wearing one. If the participant was in the visual/verbal condition they were asked to wear SenseCam for the duration of the test. The examiner read the researcher instructions to the participant (see Appendix 5) and then, to clarify that they understood, asked the participant to tell them what they had to do. The participants were then asked if they had any questions and any aspects of the instructions were clarified at that time.

The participant was reminded that the examiner would be following close behind observing the participant and that they should not be spoken to unless it was part of the test. The test then commenced, starting outside the main hospital reception. The examiner followed the participant, recording notes on the objective behaviour of the participant so that performance could be scored.

Stage 2

Data collection point 1a, 2a, and 3a: At the end of the test the participant was asked how many errors that they thought they had made in total and each of the four MET-HV error categories. These were task errors, rule breaks, inefficiency errors, and interpretation errors. These questions were asked so that actual errors on the task could be compared with perceived errors (see below for details on how performance errors were assessed). Performance on the 1st MET-HV was then marked to obtain actual number of errors made on the test.

Stage 3

One week after undertaking the first MET-HV the participant was given feedback about their performance. Prior to the feedback session the researcher prepared the feedback to a set protocol (see below). This was undertaken in a quiet room on the participant's ward. Depending on which group the participant was in this was either verbal feedback or both visual and verbal feedback. The session began with the researcher reading out the feedback session instructions (see Appendix 6). This included asking the participant to read out the instructions for undertaking the MET-HV. They were told that they could look at the instructions at any time whilst the feedback was being given. It was emphasized that questions could not be answered during feedback and any could be addressed after it was finished. The feedback was then given to the participant. At the end of feedback any questions were addressed.

Stage 4

Immediately after the feedback session the participant undertook their second MET-HV. This followed the same procedure as the first MET-HV.

Stage 5

Data collection point 1b, 2b, and 3b: At the end of the test the participant was again asked how many errors that they thought they had made in total and in each of the four MET-HV error categories. Performance on the 2^{nd} MET-HV was then marked to obtain actual number of errors made on the test. Finally, participants were then debriefed regarding their performance.

Assessing performance on the MET-HV

Researcher notes were used to assess performance using four error categories as defined in the MET-HV- (1) *inefficiencies*—where a more effective strategy could have been applied; (2) *rule breaks*—where a specific rule (social, or one of the nine explicitly defined within the test) was broken; (3) *interpretation failure*—where the requirements of a task had been misunderstood; (4) *task failures*—where any one of the 12 tasks had not been fully completed. Following the procedure developed by (Knight et al., 2002) the notes were scored by two independent raters: first by the researcher who accompanied the participant; and second, by a member of the psychology team at Kemsley. Any differences between scores were discussed and a consensus was agreed upon.

Feedback protocol

The researcher notes on what the participant did during the MET-HV were broken down into statements that were approximately 6 seconds long and typed onto a separate feedback sheet (see Appendix 7). For example, “You started by walking into the main building. You went up to the main reception and waited to be served”. The feedback sheet represented a linear description of what the participant did. To ensure that the feedback in both groups took approximately the same amount of time each 6-second statement for the verbal/visual group was accompanied by three SenseCam images. The three images that best represented the statement were picked, and shown whist the statement was being read. For example, the statement: “You crossed the road and headed towards the medical library. When you got there you looked at the door and wrote something down” could be represented by the following images:



The errors were also broken down into statements approximately 6 seconds long. For example, “Next you went back into the main building. This was an error. One of the rules was ‘no building should be entered other than to complete part of the task inside’”. It was not possible to feedback about some errors during the linear description of what the participant did. This was because some errors were about the participant not doing something and as the tasks could be done in any order there was no specific time to fit these errors into the linear description. These errors were therefore fed back after the linear description was complete.

Results

Preparation for statistical analysis

Before undertaking any statistical analysis, the Kolmogorov-Smirnov Test was used to test all variables for normality. None of the variables significantly differed from a normal distribution and therefore parametric tests were used to analyse the data.

Descriptive statistics

Table 1 below shows the descriptive statistics for the participant characteristics and the pre and post intervention data. Analyses were performed to assess for any significant differences between the verbal and visual/verbal groups. Chi-squares were performed on the categorical data and independent t-tests were performed on the continuous data. Only one of these tests reached significance, specific self-awareness after MET-HV 1 ($p=.005$). This will be discussed below. None of the other tests reached significance indicating that there were no significant differences between the groups on the remaining variables. The mean memory scaled scores for both groups on each subtest indicate that the participants are within what is considered a broadly normal range of functioning (Lichtenberger, Kaufman, & Lai, 2001). The DEX scores show that there is a mean discrepancy across participants between self and other scores of 9.77. This indicates that overall the participants regard themselves as having fewer deficits than significant others. Note that scores for how well the participant knew the hospital grounds were measured using a four point scale (0 = not at all, 1 = somewhat, 2 = fairly well, 3 = very well). The DEX discrepancy scores were obtained by taking the DEX other score away from the DEX self score. The minus scores for both groups indicate that on average all participants rated their abilities as higher than the person rating them.

Table 1: Participant characteristics and pre and post intervention data

	Verbal group (mean and S.D)	Vis./verb. Group (mean and S.D)	Sig. difference	Total (mean and S.D)
Males	6 (total)	7 (total)	p = .599	13 (total)
Females	3 (total)	2 (total)		5 (total)
Age (years)	35.56 (12.14)	38.00 (10.90)	p = .659	36.78 (11.26)
Time since injury (years)	11.59 (6.49)	14.60 (9.29)	p = .437	13.10 (7.92)
Time in hospital (years)	1.99 (1.57)	3.17 (3.34)	p = .354	2.58 (2.61)
How well know hospital grounds (4 point likert scale)	1.78 (0.44)	2.00 (0.71)	p = .435	1.89 (0.58)
Errors on 1st MET-HV	10.56 (2.60)	13.22 (6.16)	p = .249	11.89 (4.79)
Errors on 2nd MET-HV	9.00 (2.92)	8.22 (5.24)	p = .702	8.61 (4.13)
General self-awareness after 1st MET-HV	21.05 (15.73)	20.61 (22.26)	p = .963	20.83 (18.70)
General self-awareness after 2nd MET-HV	28.44 (23.87)	38.77 (38.32)	p = .502	33.60 (31.42)
Specific self-awareness after 1st MET-HV	45.02 (13.11)	22.12 (16.38)	p = .005*	33.57 (18.60)
Specific self-awareness after 2nd MET-HV	34.79 (28.77)	43.43 (33.67)	p = .567	39.11 (30.70)
Feedback time (minutes)	6.00 (2.06)	7.44 (1.24)	p = .090	6.72 (1.81)
WTAR (scaled score)	100.33	98.89	p = .562	99.61 (14.80)
RBMT – Question 3 (pass or fail)	Pass = 6 Fail = 3	Pass = 7 Fail = 2	p = .599	Pass = 13 Fail = 5
RBMT – Question 4 (pass or fail)	Pass = 6 Fail = 3	Pass = 6 Fail = 3	p = .1.00	Pass = 12 Fail = 6
WMS: Word List I – Total recall (scaled score)	6.11 (3.66)	5.67 (3.16)	p = .786	5.89 (3.32)
WMS: Word List II – Total recall (scaled score)	8.11 (3.18)	8.00 (2.24)	p = .933	8.05 (2.67)
WMS: Visual Reproduction I – Total recall (scaled score)	5.00 (3.08)	7.00 (4.50)	p = .288	6.00 (3.88)
WMS: Visual Reproduction II – Total recall (scaled score)	6.89 (3.79)	9.11 (4.40)	p = .268	8.00 (4.14)
DEX–Self (total raw score)	22.33 (13.25)	16.89 (8.08)	p = .308	19.61 (11.00)
DEX–Other (total raw score)	33.06 (12.85)	25.11 (14.21)	p = .231	29.08 (13.76)
DEX-Discrepancy (self score-other score)	-10.72 (17.20)	-8.22 (12.61)	p = .730	-9.47 (14.69)

Main results

Hypothesis 1 – Visual/verbal feedback will be superior to verbal feedback alone in improving general self-awareness of errors made on the MET-HV.

This was assessed by asking the participants how many errors they thought they had made overall after the first MET-HV, and then asking the same question again after they had received feedback and carried out the second MET-HV. General self-awareness of errors on each MET-HV was obtained by calculating the percentage of errors that each participant was aware of as a proportion of their number of actual errors. The change in general self-awareness scores between the first and second MET-HVs was obtained by calculating a discrepancy score. This was done by subtracting the percentage of errors aware of after the first MET-HV from the percentage of errors aware of after the second MET-HV. A minus score indicated a drop in awareness of errors, whereas a positive score indicated an increase in awareness of errors. This discrepancy score was used to compare any difference in the change in general self-awareness across groups using an independent samples t-test. There was no significant difference in the scores between the verbal group ($M= 7.39$, $SD= 27.98$) and the visual/verbal group ($M= 26.48$, $SD= 46.13$) conditions; $t(16) = -1.06$, $p= 0.304$.

This result suggests that type of feedback did not differentially affect general self-awareness.

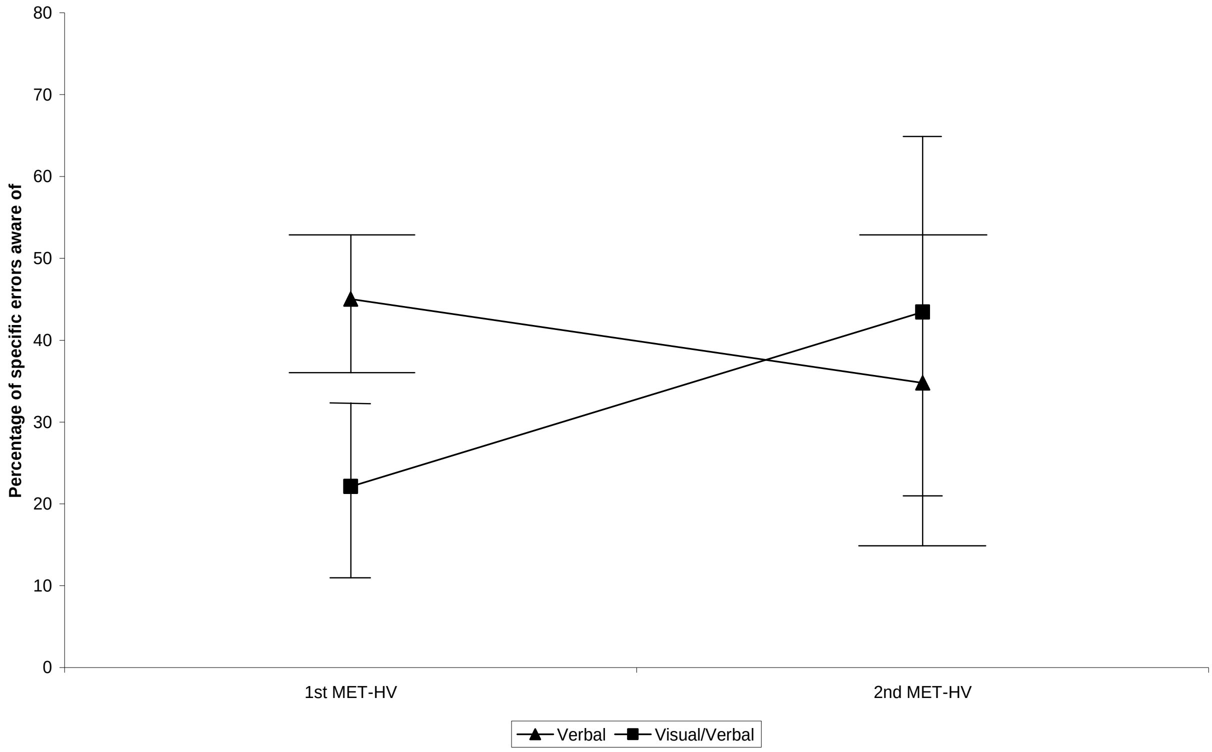
The data was also examined to explore whether there was an improvement in general self-awareness as a result of *any* feedback. A paired samples t test comparing pre and post intervention scores was performed on the groups combined (based on the percentage of errors each participant was aware of at each time point). This showed that there was no significant difference between general self-awareness on the first MET-HV ($M=20.83$, $SD=18.70$) vs. the second MET-HV ($M=33.60$, $SD=31.42$); $t(17) = -1.83$, $p=0.085$.

Hypothesis 2 – Visual / verbal feedback will be superior to verbal feedback alone in improving specific self-awareness of errors made on the MET-HV.

This was assessed by asking the participants how many errors they thought they had made in each of the error categories after both the first and second MET-HVs. Specific self-awareness of errors for each MET-HV was obtained by calculating the percentage of errors each participant was aware of as a proportion of their number of actual errors. The change in specific self-awareness scores between the first and second MET-HV was again obtained by calculating a discrepancy score. This was done by subtracting the percentage of errors aware of (when asked about the separate error categories) after the first MET-HV from the percentage of errors aware of (when asked about separate error categories) after the second MET-HV. A minus score indicated a drop in awareness of errors, whereas a positive score indicated an increase in awareness of errors. This discrepancy score was used to compare any difference in the change in specific self-awareness across groups using an independent samples t-test. This showed a significant difference between the scores in the verbal group ($M= -10.23$, $SD= 22.47$) and visual/verbal group ($M= 21.30$, $SD=36.14$) conditions; $t(16) = -2.22$, $p=0.041$.

This result suggests that visual/verbal feedback significantly improves specific self-awareness of errors on the MET-HV more than verbal feedback alone. Figure 2 shows the mean percentage of specific self-awareness for each group at each time point (NB this is based on actual percentage scores not on discrepancy scores).

Figure 2: Graph showing the mean percentage of errors aware of when asked at a specific level and error bars for each group at each time point (specific self-awareness)



The data was also examined to explore whether there was an improvement in specific self-awareness as a result of *any* feedback. A paired samples t test comparing pre and post intervention scores was performed on the groups combined (based on the percentage of errors each participant was aware of at each time point). This showed that there was no significant difference between specific self-awareness scores on the first MET-HV (M=33.57, SD= 18.60) vs. the second MET-HV (M=39.11, SD= 30.70); t (17) = -.70, p=0.491.

Further analysis relating to Hypotheses 1 and 2

Given that there was no significant difference between groups when participants were asked about their errors at a general level, but there was a difference when participants were asked at a more specific level, a correlation was carried out between the number of actual errors on each MET-HV and percentage of errors they were aware of at each level of questioning. Table 1 shows that the correlation between corresponding MET-HVs was greater when participants were asked about their errors at a specific level.

Table 2: Correlation between actual errors on each MET-HV and percentage of errors participants were aware of at each level of questioning (n=18).

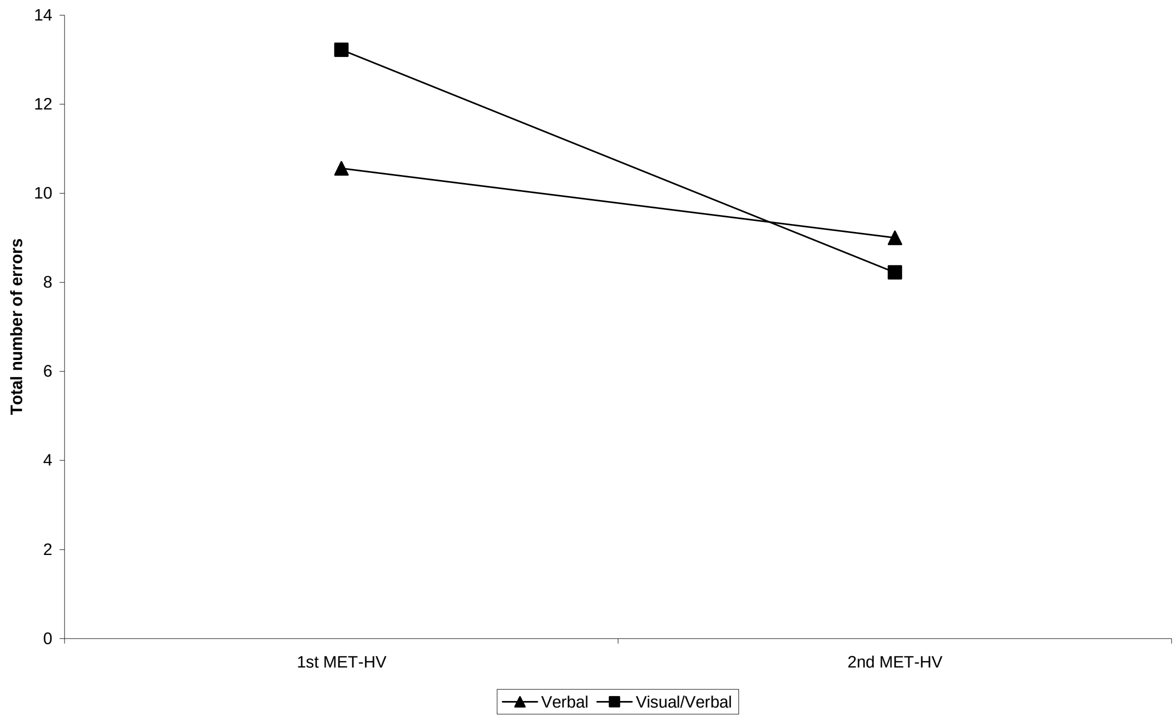
	Total errors MET-HV 1		Total errors MET-HV 2	
	r	Sig	r	Sig
Total errors MET-HV 1	1.00	N/A		
Percentage of general self-awareness after MET-HV 1	-0.37	0.13		
Percentage of specific self-awareness after MET-HV 1	-0.52	0.03		
Total errors MET-HV 2			1.00	N/A
Percentage of general self-awareness after MET-HV 2			-0.37	0.13
Percentage of specific self-awareness after MET-HV 2			-0.68	0.00

Hypothesis 3 – Visual / verbal feedback will be superior to verbal feedback alone in improving performance on the MET-HV as measured by total number of errors.

This was assessed by subtracting the total number of errors on the second MET-HV from the total number of errors on the first MET-HV. A minus score indicated an increase in the number of errors, whilst a positive score indicated a decrease in the number of errors. This discrepancy score was used to compare the change in number of errors on the MET-HV across groups. An independent samples t-test was conducted to compare change in number of errors on the MET-HV in the verbal and visual/verbal groups. There was a significant difference between the groups (t (16) = -3.04, p=0.008) with the verbal and visual/verbal groups obtaining a mean reduction in errors of 1.56, (SD= 1.67) and 5.00, (SD=2.96) respectively.

This result suggests that visual/verbal feedback significantly improves performance on the MET-HV more than verbal feedback alone. Figure 3 shows the mean number of actual errors made by each group at each time point.

Figure 3: Graph showing the mean number of errors for each group at each time point



This data was also examined to explore whether there was a reduction in errors as a result of *any* feedback. A paired samples t test comparing pre and post intervention scores was performed on the groups combined (based on the number of errors made at each time point). This showed that there was a significant difference between scores on the first MET-HV (M=11.89, SD= 4.79) vs. the second MET-HV (M=3.78, SD= 2.37); t (17) = 9.09, p=0.000.

Further analysis relating to Hypothesis 3

Given that participants in the visual/verbal group were less aware of their specific errors prior to intervention (after the first MET-HV), this could be a confounding factor i.e. their greater improvement in performance (change in errors on MET-HV) could be due to the fact that people with less awareness derive greater benefit from feedback, rather than the improvement being due to the experimental condition. A correlation was therefore carried out between percentage of specific errors aware of after the first MET-HV and change/improvement in error scores between the first and second MET-HV. This revealed a highly significant Pearsons correlation of -.66 ($p=.00$) thus providing further evidence for a possible confound.

Discussion

Main findings

The aims of this study were to explore the use of two different forms of feedback, verbal and visual/verbal, in improving self-awareness of errors and performance on a task. It was argued that visual/verbal feedback would improve self-awareness more than verbal feedback alone due to the advantages of using visual imagery to improve memory. It was suggested that, according to Agnew and Morris' model of self-awareness, facilitating the encoding of errors into memory would lead to improved self-awareness, which would lead to improved performance. Evidence and theory were presented that suggested visual feedback on errors would have a superior effect because: of the dual-coding effect (i.e. feedback would be coded into visual and verbal memory systems), it would be processed at a deeper level, and that memories for personal experiences, i.e. autobiographical memories, are thought to be largely made up of visual imagery. Self-awareness was assessed by asking participants to undertake a planning and multi-tasking test, give ratings of how many errors they thought they had made, receive feedback on performance, undertake the test again, and finally give ratings of how well they thought they had done a second time.

Two groups of nine subjects completed the research. There were no significant differences between the groups on demographic data and most variables of interest prior to intervention apart from awareness of specific errors. The first hypothesis, that general self-awareness of errors on the MET-HV would improve significantly more following visual/verbal feedback compared to verbal feedback alone, was not supported. The second hypothesis, that specific self-awareness of errors on the MET-HV would improve significantly more following visual/verbal feedback compared to verbal feedback alone, was partially supported. This result showed that the visual/verbal group improved specific self-awareness by 21.30% compared to a drop in specific self-awareness in the verbal group of -10.23%. Unfortunately however, the groups differed in their level of awareness of specific errors prior to the intervention which may be a confound, with the visual/verbal group having less awareness initially. This also meant that any difference between the first and second time points disappeared when the groups were combined in order to explore the effectiveness of feedback per se. The third hypothesis, that performance on the MET-HV would improve significantly more following visual/verbal feedback compared to verbal feedback alone, was supported but may be subject to the same confound i.e. a difference in awareness between groups prior to intervention. This result showed that the visual/verbal group reduced the number of errors they made on the second MET-HV by a mean of 5 errors. This compared to a mean reduction of 1.56 errors in the verbal group. Results also suggested a significant effect of feedback on error rate per se, although without a ‘no intervention’ control group this effect cannot be attributed to the intervention. Therefore, two out of the three hypotheses were partially supported in this study.

It was interesting that when asked about their errors at a more detailed level of questioning, participants’ responses correlated more closely with their actual number of errors than when they were asked at a more general level. This may partly also account for the lack of a significant difference between groups when they were asked at a more general level i.e. at the general level their responses may have been generally less reliable and more chaotic. This provides further support for Sherer et al’s (1998) notion that questioning at a more specific level might reduce cognitive load. In fact, in the present situation it may have aided retrieval by asking participants to think back for very specific events in turn, thus systematising their memory search.

It had been assumed that if performance on the MET-HV improved and awareness improved concomitantly, this would help to explain the mechanism by which feedback impacts on performance. Unfortunately, the bias in awareness of errors that existed prior to intervention means that the significant difference between the verbal and visual/verbal groups on specific self-awareness needs to be interpreted with caution. It also means that the significantly greater improvement in performance on the MET-HV for the visual/verbal group must also be interpreted with caution as changes in performance may have also been related to awareness with those being less aware initially, benefiting from feedback to a greater extent than those who were more aware initially. In fact the high correlation between initial levels of awareness and change in performance would support this.

Comparing the results of this study to the studies involving feedback mentioned in the introduction is problematic due to the inconclusive nature of the results and the different methodologies applied in the studies reviewed. However, the differential improvement in awareness and performance noted in this study concurs with Katz et al., (2002) i.e. this study has also demonstrated an improvement in performance but not awareness, that is unless one only considers the group who were least aware initially (the visual/verbal group) who showed improvement in both errors and awareness. Having said that, neither this study or Katz et al (2002) incorporated a control group and therefore improvements in performance could be due to a practice effect. The studies giving people feedback on their accuracy of estimating their own performance on memory and maths tasks showed improvement in accuracy of estimations (Redmann & Hannon, 1995; Sclund, 1999; Youngjohn & Altman, 1989 cited in Sherer, 2005). Although the present study provided feedback on errors rather than accuracy of estimations of performance, it also showed an improvement in estimation, albeit in one group only i.e. those who were the most unaware initially.

No real comparison can be made between the present study and the studies relating to patients with neglect (Tham et al., 2001; Tham & Tegner, 1997) as the mechanism for change may relate to the nature of neglect itself, rather than feedback per se. The studies using video feedback (Alexy et al., 1983; Liu et al., 2002) were again inconclusive demonstrating some improvements in performance and awareness. This pattern is replicated in the current study.

Study limitations

There are a number of limitations to this research. In relation to the participants the sample included people whose memory functioning (as measured by the WMS-III subtests) was within the normal range. It also included people whose awareness of their deficits appeared accurate (as measured by DEX self and other scores). The initial intention was to exploring whether feedback aids the facilitation of self-awareness regardless of cognitive deficit. It may be that focussing on participants with significant memory or self-awareness difficulties would yield a different set of results.

Fleming and Ownsworth (2006) suggest that deficits in self-awareness probably come about for different reasons in different people. For some it will be because of neurological damage, for others it will be based on psychological factors and for others a combination of the two. Langer & Padrone (1992) suggest that if a person's unawareness is mostly due to psychological factors such as denial, feedback may be counterproductive, possibly reinforcing the denial and increasing emotional distress. Whilst, Bieman-Copland and Dywan (2000) suggest that strategies based on confrontational techniques, such as direct feedback, may actually cause agitation and entrench beliefs about skills being more preserved than they are. Fleming and Ownsworth (2006) argue that interventions should be targeted depending on the cause of the self-awareness deficit. For self-awareness difficulties as a result of neurocognitive factors they suggest clear feedback, structured opportunities to learn, and repetition to encourage habit formation; whilst for self-awareness difficulties resulting from more psychological factors they suggest non-confrontation psychotherapy and counselling techniques. However, they concede that making a decision about the cause of self-awareness deficits is a difficult task. They point to information such as lesion location, neuropsychological assessment, client's reactions to feedback, and measures of coping style and personality that can aid this task.

Therefore, Langer and Padrone (1992) and Bieman-Copland and Dywan (2000) are both suggesting that direct feedback may not be suitable for everyone and according to Fleming and Ownsworth (2006) this is with people whose deficits in awareness are more psychological in nature. The feedback style in this present study was direct and could have been seen as confrontation by some participants. It is therefore possible that this style of rehabilitation did impact on some people's levels of agitation and did lead to more defensiveness. This may explain the drop in specific self-awareness in the verbal group. Subjectively, the researchers in the study did observe agitation during feedback and, as mentioned above, two participants dropped out of the study after their feedback session, reporting not liking being told what they had done wrong.

Another limitation of the study links to the experimental procedure. It was not possible to capture all errors with images. For example, when a participant failed to do a task, such as not collecting something this could not be directly represented with images. In general errors that were rule breaks lent themselves to feedback via images. These included things such as going back into a building twice, or buying more than two items from the hospital shop. In total 24% of the errors for the visual/verbal group could not be represented by images and verbal feedback alone was used.

The original aim of this study was to collect 22 participants. This proved problematic for a number of reasons. As the task took place around the grounds of the Northampton site of St Andrews Healthcare recruiting participants from other locations was not feasible. This limited the pool of possible participants to 87. As mentioned in the methodology many of the patients admitted to Kemsley did not meet the inclusion or exclusion criteria, leaving only 32 to approach. Obtaining 18 participants from a possible 32 represents a 56.25% response rate.

There was no independent assessment of the outcome data. The researchers involved in collecting the data were aware of the aims of the study and the use of SenseCam made it clear which condition participants were in. It is possible that this influenced the recording of the outcome data by the researchers. However, due to the objective nature of the outcome measure this should have limited any possible researcher biases. The process of blinding the participants to the aims and conditions of the research was also problematic. The hypotheses, that SenseCam would improve self-awareness and performance more than verbal feedback, was not made explicit in the information sheet for participants. However, sections in the sheet about SenseCam could have indicated this was the case. Therefore, it is possible that the participants in the SenseCam group may have been influenced to meet this expectation.

Finally, the issue of generalisability of the intervention needs to be considered. Although the participants improved performance on the MET-HV it is not clear whether this improved performance would lead to better functional skills generally. This could have been assessed by incorporating a measure of how the feedback addresses general abilities like shopping, and finding out information.

Future directions and clinical implications

The results of this study provide some suggestions for future areas of research. The significant improvement in performance on the MET-HV under the visual/verbal condition suggests that feedback based on SenseCam images may be having a beneficial effect, albeit in people who have poor self-awareness. This effect needs to be further researched. The heterogeneity of difficulties experienced by people with a brain injury makes matching samples difficult. It may be that a series of single cases would allow researchers to analyse the effect of visual/verbal feedback based on SenseCam images in a more controlled way, although this would rely on the availability of parallel versions of the MET-HV. Alternatively, exploring the effect of visual/verbal feedback based on SenseCam images in samples with different neuropsychological profiles may provide further insight into its efficacy. Possible samples to explore would be participants with marked memory or self-awareness difficulties.

Other areas to explore would be the use of SenseCam to aid feedback in real life functional and behavioural areas. For example, the use of SenseCam and the first-person perspective images that it produces in activities such as cooking or work related performance may provide added insight for someone compared to verbal or video feedback. It could also be used to highlight times when someone has difficulty with emotional regulation, indicating triggers and events that lead up to the situation. Certain aspects of the SenseCam design may need some modification for this. As the camera hangs loose around the neck wearing it whilst undertaking tasks can lead to the camera being unstable and producing blurred pictures. Having the ability to fix the camera to an area of the person would aid the recording of images of activities.

The clinical implications of this research are potentially significant. Improving self-awareness of functioning has been shown to have a number of benefits for people with a brain injury. Although, the results of the study were inconclusive they did partly suggest an effect of visual/verbal feedback on self-awareness and performance that was greater than verbal feedback alone. Both general and specific self-awareness improved by over 20% in the visual/verbal condition after just one feedback session. This figure is potentially clinically significant and given extra feedback sessions participants may improve their self-awareness further. The use of SenseCam to collect the visual images also has clinical implications. SenseCam is small, portable, takes little time to set up, or to deliver its images, and is therefore very practical for rehabilitation professionals. In relation to providing feedback it is much more viable than continuous video recording. Improving functioning on everyday tasks is one of the main goals of rehabilitation and this was demonstrated during this research. If further research provides greater evidence of SenseCam's impact, its use during routine brain injury rehabilitation could become commonplace.

If the present results were due to the degree of unawareness initially, rather then the experimental condition, this also has important clinical implications and supports the suggestions made by Sherer et al. (1998) that provision of specific feedback is a very important component in promoting self-awareness. However, given the slight drop in error awareness in the group who were potentially more aware initially, this kind of feedback should be used with caution.

Conclusions

In conclusion, visual/verbal feedback using SenseCam was shown to improve performance on the MET-HV significantly more than verbal feedback alone. Unfortunately, it is not possible to say that this was because participants showed a greater improvement in self-awareness in the visual/verbal feedback condition, as there was a bias in awareness of errors prior to intervention with those who benefited the most (the visual/verbal group) showing the least awareness initially. The results obtained could therefore be due to the superiority of the visual/verbal condition or the fact that people with less awareness benefit from feedback to a greater extent. Interestingly, results also suggested that participants' reporting of errors is more accurate if the questioning is broken down and asked at a very specific level.

The clinical implications of this study need to be further researched, however results to date are leaning towards potential clinical benefits of using SenseCam.

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Public Domain Briefing Paper

Executive Functioning and Self-Awareness Following Brain Injury

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Literature Review

How Effective are Interventions to Rehabilitate Executive Functioning Following Traumatic Brain Injury?

Background and Aims

Deficits in executive functioning are common following traumatic brain injury (TBI). Complex skills such as problem-solving, planning, multi-tasking, self-monitoring, and error correction require the executive functioning system. This system is thought to operate by regulating more basic cognitive systems, such as attention, memory, social behaviour and comprehension to undertake complex, goal-directed and purposeful behaviour. Therefore deficits in executive functioning can have wide-ranging implications.

Reviews in this area were undertaken up to 2005 (Cicerone et al., 2000; Cicerone et al., 2005; Kennedy et al., 2008). However, more research was required to add to the limited evidence-base. This review was therefore undertaken to investigate whether new research had been done since 2005 which could be used to add to the evidence-base and provide recommendations for clinical practice.

Results

Seven papers were reviewed in this study. Five employed a quantitative approach and two were case studies. Three of the studies used a multi-strategy instruction (MSI) approach – a step by step approach that included ‘acknowledging and/or generating goals, self-monitoring and self-recording of performance, and strategy decisions based on performance-goal comparison in which individuals adjust the plan based on self-feedback or external feedback' (Kennedy et al., 2008); one study used a combination of feedback, education, and reasoning about problem solving; one paper used a combination of MSI and feedback, education and reasoning; and three studies used problem-solving techniques that drew on the use analogies of solving previous similar problems or previous problem-solving experiences.

Conclusions

This review provided added evidence for the use of MSI as an intervention approach. Further research on the use of problem solving using previous experience is required before a full recommendation for its use can be made. Other areas of research suggested by the review include the use of analogies to aid problem-solving, the use of computer generated simulations of real-life situations to learn problem-solving skills, and using Goal Management Training to treat executive problems resulting from damage to the cerebellar region of the brain.

Empirical Paper

The effect of Visual and Verbal Feedback on Self-Awareness: An Application of SenseCam

Background and Aims

Following brain injury people are not immediately aware of their subsequent difficulties (e.g. cognitive, emotional, social or behavioural functioning) and can often underestimate them. Impairments in awareness can have a number of wide-ranging implications, including increased likelihood to be referred for more intensive post-acute rehabilitation (Malec & Degiorgio, 2002); poor compliance and participation in treatment (Lam, McMahon, Priddy, & Gehred-Schultz, 1998); longer stays in rehabilitation (Malec, Buffington, Moessner, & Degiorgio, 2000); poorer functional status at discharge from rehabilitation (Sherer et al., 2003); and poorer employment outcomes (Sherer et al., 1998).

Reviews on interventions for self-awareness suggest the use of various intervention strategies (Fleming & Ownsworth, 2006; Sherer, 2005). However, strategies employing feedback were recommended for people whose awareness is a result of neurological damage. The aim of this research therefore was to compare two forms of feedback – verbal and visual/verbal – and their impact on self-awareness and performance. This study also drew on a model that implicates long-term memory in the process of gaining self-awareness (Agnew & Morris, 1998).

A new wearable camera, developed by Microsoft, called SenseCam was used to record the visual/verbal feedback. It is worn around the neck and takes pictures from a first-person perspective. These are taken when there are certain changes in the environment, such as changes in light or sound, or at specific time intervals, for example every 10 seconds.

Methodology

Eighteen participants were allocated to one of two groups – visual or visual/verbal feedback. Participants undertook a planning and multi-tasking test around the grounds of a hospital; they then gave ratings on awareness of their errors on that test; received feedback on their performance, undertook the test again, and then gave ratings on awareness of their errors a second time. Ratings of awareness of errors were obtained generally (i.e. how many errors do you think you made) and in relation to the specific error categories of the test. Improvements in awareness of errors was obtained by calculating the discrepancy between the first and second rating of errors.

Results

There was no significant difference between the feedback groups in general awareness of errors. Awareness of specific error categories improved for visual/verbal feedback significantly more than for verbal feedback. Visual/verbal feedback also improved performance significantly more than verbal feedback. However, the results were subject to bias due to the verbal and visual/verbal groups having different levels of awareness after the first test. This meant that visual/verbal group may have improved significantly more because they had significantly less awareness at the start.

Conclusions and Clinical Implications

Visual/verbal feedback improved awareness of specific errors and performance on a planning and multi-tasking test significantly more than verbal feedback. However, bias in the data limit any conclusions that can be drawn. Results suggested that participants' reporting of errors was more accurate after questioning was broken down to specific levels.

Although, the results of the study were inconclusive they did partly suggest an effect of visual/verbal feedback on self-awareness and performance that was greater than verbal feedback alone. This effect was found after one feedback session and given extra sessions participants may improve their self-awareness and performance further. The use of SenseCam to collect the visual images also has clinical implications. SenseCam is small, portable, takes little time to set up, or to deliver its images, and is therefore very practical for rehabilitation professionals. In relation to providing feedback it is much more viable than continuous video recording. Improving functioning on everyday tasks is one of the main goals of rehabilitation and this was demonstrated during this research. If further research provides greater evidence of SenseCam's impact, its use during routine brain injury rehabilitation could become commonplace.

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Appendix 1

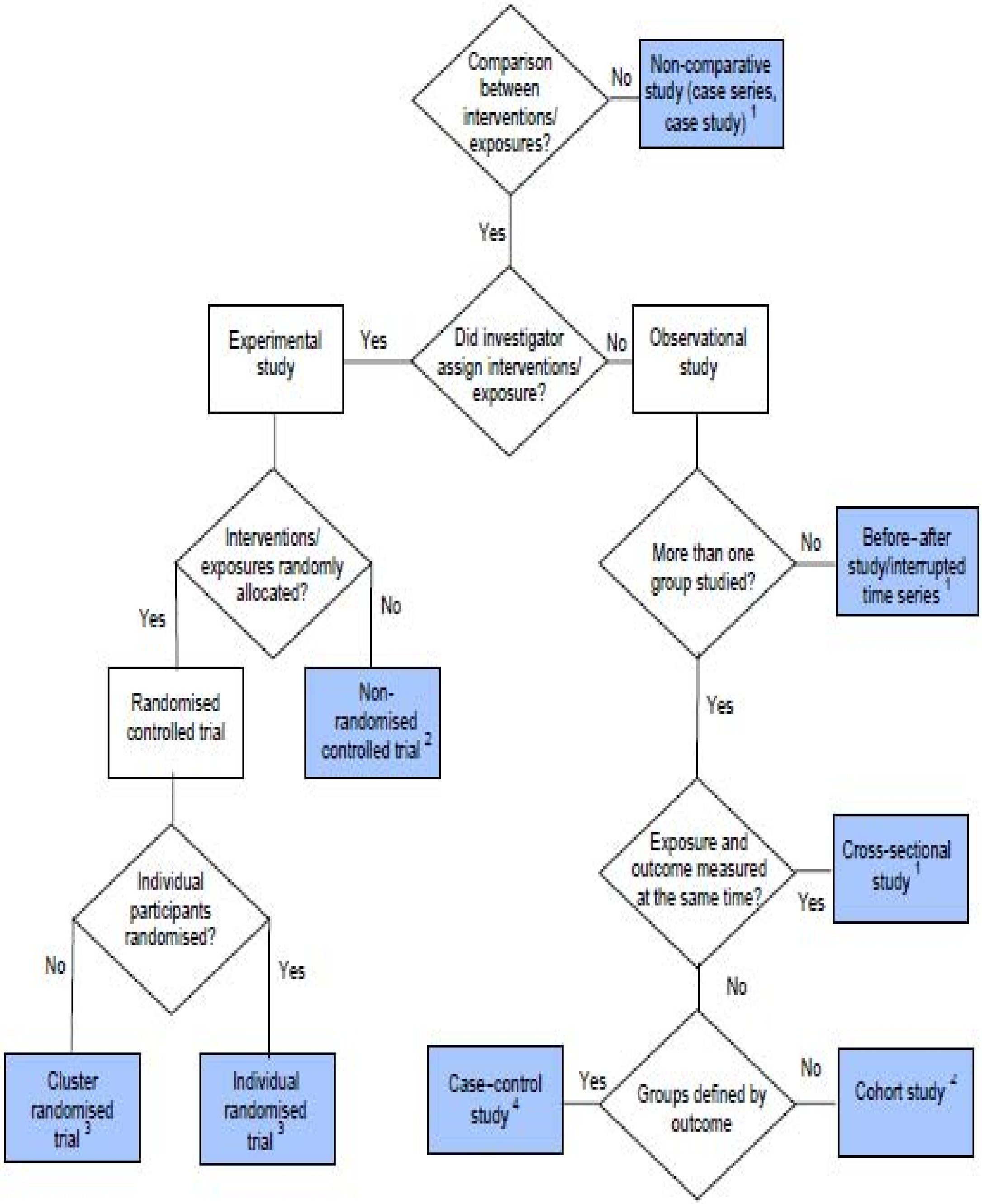
Definitions for Classification of Evidence taken from

AAN Clinical Practice Guideline Process Manual (Edlund et al., 2004)

Suggested wording	**Translation of evidence to recommendations**	**Rating of Therapeutic Article**
Conclusion: A = Established as effective, ineffective or harmful for the given condition in the specified population **Recommendation:** Should be done or, should not be done	Level A rating requires at least two consistent Class I studies*	**Class I:** Prospective, randomized, controlled clinical trial with masked outcome assessment, in a representative population. The following are required: a) primary outcome(s) clearly defined b) exclusion/inclusion criteria clearly defined c) adequate accounting for drop-outs and cross-overs with numbers sufficiently low to have minimal potential for bias d) relevant baseline characteristics are presented and substantially equivalent among treatment groups or there is appropriate statistical adjustment for differences.
Conclusion: B = Probably effective, ineffective or harmful for the given condition in the specified population **Recommendation:** Should be considered or, should not be considered	Level B rating requires at least one Class I study or two consistent Class II studies	**Class II:** Prospective matched group cohort study in a representative population with masked outcome assessment that meets a-d above OR a RCT in a representative population that lacks one criteria a-d.
Conclusion: C = Possibly effective, ineffective or harmful for the given condition in the specified population **Recommendation:** May be considered or, may not be considered	Level C rating requires at least one Class II study or two consistent Class III studies	**Class III:** All other controlled trials (including well-defined natural history controls or patients serving as own controls) in a representative population, where outcome is independently assessed, or independently derived by objective outcome measurement.
Conclusion: U = Data inadequate or conflicting. Given current knowledge, is unproven **Recommendation:** None	Studies not meeting criteria for Class I – Class III	**Class IV:** Evidence from uncontrolled studies.

Appendix 2

Flow diagram for classifying study design for questions of effectiveness taken from The Guidelines Manual (National Institute of Health and Clinical Excellence, 2007)



Appendix 3

Table of evidence

	Hewitt et al (2006). Theory driven rehabilitation of executive functioning: Improving planning skills in people with traumatic brain injury through use of an autobiographical episodic memory cueing procedure	Ownsworth et al (2008) Comparison of individual, group and combined intervention formats in a randomised controlled trial for facilitating goal attainment and improving psychosocial function following acquired brain injury	Soong et al. (2005). A pilot study of the effectiveness of tele-analogy-based problem-solving training for people with brain injuries	Wai-Wong et al (2006). Development and evaluation of a pictorial-based analogical problem-solving programme for people with TBI	Ownsworth et al (2006) A metacognitive contextual intervention to enhance error awareness and functional outcome following traumatic brain injury: A single case experimental design	Satish et al (2008). Simulation-based executive cognitive assessment and rehabilitation after traumatic frontal lobe injury: A case report	Schweizer et al (2008). Rehabilitation of Executive functioning after focal damage to the Cerebellum
Type of evidence	Class I	Class I	Class IV	Class IV	Class IV	Class IV	Class IV
Demographic variable							
Number of participants	30 (2 groups of 15)	35 (3 groups - 12, 12,11) + waiting list group of 17	15 (3 groups of 5)	50 (2 groups - experiemental=30; control=20)	1	1	1
Gender	1	1	1	1	1	1	1
Time post-injury	1	1	1	1	1	1	1
Age in years	Trained group=38.47; SD=14.72 Control Group=33.13; SD 8.25	43.89; SD=12.6	Group 1=38.6; SD=14.17 Group 2=35.6; SD=16.33 Group 3=37.4; SD=11.08	Training group=44.87; SD=10.47 Control group=48.55; SD=8.85	36	47	41
Time since injury	1	1	1	1	1	2	1
Neuropsychological tests	1	0	0	1	1	1	1
Aetiology	1	1	1	1	1	1	1
Evidence of severity (GCS; Glasgow Outcome Score; LOC; PTA; imaging)	1	1	0	0	1	1	1
Severity at study	0	1	0	0	1	1	1
Education in years	0	0	1	1	1	1	1
Exclusion criteria	1	1	1	1	0	0	0
Treatment history	0	0	0	1	1	1	1
Post-injury living situation	0	0	0	0	1	1	0
Motor function	0	0	0	0	0	1	0
Language spoken	1	1	0	1	1	1	0
Pre-morbid occupations, pre-injury IQ, pre-injury living situation, family status, socioeconomic status, race, vision, hearing status, medications, control occupations	0	0	0	0	Some	1	Some

Study design, intervention characteristics and data analysis		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Rationale	1	1	1	1	1	1	1
Study design	RCT	RCT	RCT	RCT	Single-case experimental design	Case study	Case study
Control group	1	1	0	1	0	0	0
Evidence of experimental control	1	1	0	1	0	0	0
Statistics - p values	1	1	1	1	0	0	0
Duration	1	1	1	1	1	1	1
Frequency	1	1	1	1	1	1	1
Replicability: manual or reference	1	1	1	1	1	1	1
Treatment setting	0	1	0	0	0	0	0
Who delivered treatment	0	1	0	0	0	1	0
Treatment	Autobiographical episodic memory cuing	Metacognitive intervention + problem solving programme	Analogy problem-solving skills training programme - 3 versions	Pictorial based analogical problem solving programme	Metacognitive intervention	Simulation-based executive cognitive assessment and rehabilitation	Goal Management Training
Generalisation treatment	0	0	0	1	0	0	0
Maintenance treatment	0	1	0	1	1	0	1
Independent assessment of outcome	1	1	0	0	0	0	0
Statistics - effect size	1	1	0	0	0	0	0
Outcomes	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Activity and / or participation based	1	1	1	1	1	1	0
Neuropsychological / standardized test based	0	1	1	1	0	0	1
Self/relative rated	0	1	0	0	0	0	1
Objective / subjective	Objective	Subjective	Objective	Objective	Objective	Objective	Both
Maintenance	0	1	0	1	1	0	1
Generalisation	0	0	0	0	0	0	0

Appendix 4

Participant Instructions: MET-HV

In this exercise you should complete the following three tasks:

1. You should do the following 6 things:
2.
    - Collect something for John Burns from the Main Reception and do what is necessary
    - Buy 4 1st class stamps
    - Buy a get well card
    - Buy a bottle of Coca-Cola
    - Telephone Kemsley Reception and say where you are, who you are, and what time it is
    - Post something to John Burns in Birmingham

3. You should obtain the following information and write it down in the spaces below:

1. What is the closing time of the medical library on a Friday?
2. What is the opening time of Tomkins on a Saturday?
3. What is the price of a Mars Bar?
4. How many car parks are there in the hospital grounds?

3. You must meet me outside Main Reception 20 minutes after you started the task and tell me the time

Tell the person observing you when you have completed the exercise

Whilst carrying out this exercise you must obey the following rules:

- You must carry out all these tasks but may do so in any order
- You should spend no more than £5.00
- You should stay within the limits of the hospital grounds
- You should not enter any of the hospital wards or “staff only” areas
- No building should be entered other than to complete part of the task inside
- You should not go back into a building you have already been in
- You should buy no more than 2 items in Tompkins
- Take as little time to complete this exercise without rushing excessively
- Do not speak to the person observing you *unless* this is part of the exercise

Appendix 5

Researcher instructions: administering MET-HV

The test makes use of the following items:

- Participants should be given: Pen/pencil; Sensecam (if in Sensecam group); Participant instructions – MET-HV on a clipboard; Carrier bag; £5 note
- Researcher to have a stopwatch, copy of Scoring form – MET-HV, Record of events form and pen
- Leave the Envelope (with John Burns' name and address on) at main reception

Ensure the participant is wearing a watch, and that the envelope (marked for the urgent attention of John Burns) is left at the Main Reception before beginning the procedure.

If this is the participants first MET-HV, before starting obtain ratings for familiarity of hospital grounds and record on Scoring form – MET-HV (see Scoring form – MET-HV for question).

Begin the task outside the main reception of the hospital. Give the participant the instructions and clipboard, pen/pencil, carrier bag and £5 note. If the participant is in the Sensecam group ask them to put Sensecam around their neck and switch it on. Read the following instructions to the participant:

> In this exercise I want you to complete 3 tasks. The tasks are: to do the 6 things listed on this sheet *(Researcher to indicate 6 things to do)*; to obtain and write down 4 pieces of information *(Researcher to indicate 4 pieces of information)*; and to meet me here outside main reception 20 minutes after I have said "…begin the exercise" and tell me the time.
>
> However, while completing this exercise you must obey the rules listed on your instructions sheet *(Researcher to indicate rules on sheet).*
>
> You must carry out the tasks but you may do so in any order. You should stay within the limits of the hospital grounds. This means you must not leave by any of the entrances / exits. You must not enter any ward area or area where staff only are allowed. No building should be entered other than to carry out part of the task, so if you go into a building it must be with the intention of completing part of the task. You should not go back into a building you have already been in, so if you have been into a particular building you should not go back into it again. You should buy no more than 2 items from the hospital shop. Take as little time as possible to complete this exercise without rushing excessively. There is no time limit to completing the task.
>
> During this exercise I shall be following you from a distance and observing what you are doing. Please do not speak to me unless this is part of the exercise. Finally, approach me and tell me when you have completed the exercise.

Say following statement if participant is in the Sensecam group:

Please do not touch Sensecam during the test as it will be taking pictures throughout.
Is that all clear, have you any questions? *(Clarify any questions).*

If the Participant asks any questions relating to how to do the task answer in the following way:

Unfortunately I can't tell you how to do the task. Just do the best you can

Now tell me what you must do. (*Ensure participant is clear about what they must do).* Start the stopwatch and say: “Begin the exercise”

Please turn over for further instructions
If the participant speaks to you during the test say the following:

Unfortunately I can’t answer any questions or speak to you during the test. Please carry on.

On completion of the task (when participant indicates they have finished):

- Switch off Sensecam; stop the stopwatch

- Obtain ratings for how many errors the participant thinks they have made (in the different error categories) and how well they have done and record on Scoring form – MET-HV (see Scoring form – MET-HV for questions).

- Plug Sensecam into laptop and import images using the Sensecam Import option that pops up. Name the images using following name: Participant [number] MET [1 or 2] (e.g. “Participant 7 MET 1”)

Appendix 6

Researcher instructions: administering feedback

During feedback you will need the following items:

- Participant instructions
- Laptop with selected Sensecam images ready (if doing Sensecam feedback)
- Examiner to have a stopwatch, copy of the participants Scoring Form - MET-HV, Feedback form, and a pen

Ensure the participant is sat down in a quiet room. Give the participant the participant instructions. Read the following instructions to the participant:

> The purpose of this session is to provide you with feedback on the recent task you did around the hospital grounds *(researcher to provide reminders of the things participant did if needed).*
>
> Please can you read out the instructions for the test that are on the sheet in front of you. *(wait for the participant to finish reading the instructions, answering any questions they have)*
>
> Are they clear, have you any questions? You can look at the instructions at anytime during the feedback session.
>
> During the feedback I will point out any errors that you may have made. Whilst giving you feedback I will not be able to answer any questions. This is because in this research we are comparing two groups and we need to make sure that both groups get the same information. If some people ask questions it is possible that they will receive more information.

If providing verbal feedback read the following instructions to the participant:

> I will now read through exactly what you did

If providing the Sensecam feedback read the following instructions to the participant:

> I will now read through and show you images of exactly what you did

Begin the feedback and record the length of time it takes with the stopwatch.

Verbal feedback
Use the Feedback Form to read out exactly what the participant did during the MET-HV. Read out what the participant did in the first person e.g. "You started at reception and walked to the shop". Each statement should last approximately 6 seconds.

Sensecam feedback
When providing feedback with Sensecam the same process can be used but the images that relate to the statements should be shown simultaneously. Using the Sensecam images should

not mean that the feedback takes longer than the verbal feedback. Images should not be lingered on and if asked you cannot go back to an image.

Open up the Sensecam Image Viewer software and select the relevant folder for viewing (this will be the folder of images that was created earlier called “[Participant Number] Feedback”). Use the Feedback Form to read out exactly what the participant did during the MET-HV. For each statement that you read, including error statements, flick through the corresponding Sensecam images, staying on each image approximately 2 seconds. There should be a maximum of 3 Sensecam images per statement and each statement should take approximately 6 seconds to read.

Errors that do not have corresponding images should be read out at the end.

Participant questions during feedback
If a participant asks any questions during feedback please use the following phrase, and then carry on with the feedback:

“Unfortunately I can’t answer your questions at this time. I can answer questions at the end of testing”

If the participant asks to see an image again use the following phase, and then carry on with the feedback:

“Unfortunately I can’t show you any of the images again at this time. If you want to see them again I can show you at the end of testing”

Appendix 7

Example of Feedback Form

Participant number: 1

Group: Verbal

Date of feedback: 30 Aug 08

You started by walking into the main building. You went up to the main reception and waited to be served.

You asked the receptionist if she had something for John Burns and she handed you the envelope.

You then looked at your instructions and after a while asked the receptionist how many car parks there were in the hospital.

The receptionist said about 10 and you wrote that number down. You then went out of the main reception and looked again at your instruction sheet.

You then spoke to me – asking what else you had to do. This was an error. One of the rules was “do not speak to the person observing you unless this is part of the exercise”.

You waited outside the main reception for a while, looking at your instruction sheet. You then spoke to me again. This was an error. One of the rules was “do not speak to the person observing you unless this is part of the exercise”.

You then went away from the main building towards the church. You went passed the church and turned the corner going towards the medical library.

You went up to the door of the medical library and wrote down the closing time on your sheet.

You then crossed the road and headed towards Tomkins. You got to Tomkins and headed in the door.

You went towards the counter and waited in line. When it was your turn to be served you spoke to the woman behind the counter and handed your instruction sheet to her.

She read what you needed to buy and started to collect the items. She firstly gave you a book of stamps.

You looked at these and then asked me if it was ok that there were 6. This was an error. One of the rules was “do not speak to the person observing you unless this is part of the exercise”.

The woman then gave you a bottle of coke and a get well card and you gave her the money for the three items. This was an error. One of the rules was “you should buy no more than 2 items from Tomkins”.

You then went over to the table and looked at your instructions for a while. You asked me whether I wanted the card and stamps. This was an error. One of the rules was “do not speak to the person observing you unless this is part of the exercise”.

You then went up to one of the people that work in Tomkins and asked her what time Tomkins opens on Saturday. You wrote this down and then asked her the price of a Mars bar.

Going up to the counter to ask for things on two separate occasions was an error. One of the rules of the test was to “take as little time to complete the exercise” as possible.

You then looked at your instructions again. You asked me if you could phone Kemsley reception on your phone. This was an error. One of the rules was “do not speak to the person observing you unless this is part of the exercise”.

You looked at your phone for the number but couldn’t find it. You went out of Tomkins and went over towards Isham.

You went inside to the main reception. You asked a member of staff if you could borrow the phone to call Kemsley reception.

The member of staff asked you if you knew the number. You said no so they called the operator who put them through to Kemsley main reception.

You spoke to reception and told them your name, where you are and what time it is. You said goodbye and put the phone down.

You went out of Isham and towards Kemsley reception. You walked down the road and reached reception. You went into Kemsley reception.

You asked the receptionist to read the instructions. You then asked her to post the letter for you. She put a stamp on it and said she would post it for you.

You then spoke to the manager of Kemsley and asked her about a vending machine for Kemsely South East. This was an error because one of the rules of the test was to “take as little time to complete the exercise” as possible.

You finished talking and told me you had finished the exercise.

Other errors

You also made one other error:

You did not meet me outside Main Reception 20 minutes after you started the task and tell me the time. You were required to do this.

Appendix 8

Guidelines for recording participants performance on MET-HV

Record what the participant objectively did. It is important to avoid subjective interpretations about what the participant did and concentrate on observable behaviour. For example:

- Where they walked to
- What they did when in buildings
- What they picked up

Examples:

- Walked from the main reception to the shop
- Entered the shop and walked over to the shelf, picked up the can of coca-cola, went over to the till, paid for it, and left the shop
- Walked away from the shop towards the main building. Walked past the golf course, up to the car park in front of the main building. Kept going and walked around the corner. Turned around and came back past the main building and walked up to the notice board
- Whilst at the notice board marked down the closing time of the staff library

The participant may appear to change their mind at times. This can be recorded as follows:

- Walked from the shop and headed up the road away from Kemsley – turned around and headed back to the main reception

Appendix 9

Guidelines for preparing for feedback session

The following things need to be done before the feedback session can take place:

Preparing the Feedback Form
Feedback should be broken down into 6 second statements and transferred onto the Feedback Form.

- Use the Record of Events Form to break down what the participant did into 6 second statements (remember these statements are given in the first person).
- Type the 6 second statements onto the Feedback Form
- When you come to an error on the Record of Events Form type out the error statement (see below) on the Feedback Form, filling in what the person did and what they should have done
- Some errors will be something that the person didn't do (rather than something that they did wrong) and won't be recorded on the Record of Events Form. These other errors should be typed on the Feedback Form after the statements about what the participant did have finished.
- At the end the feedback form should have a chronological list of what the person did, including errors, and a list of other errors that correspond to things that the participant didn't do (and should have).
- See copy of Example of Feedback Form

Preparing the Sensecam images
To ensure that both types of feedback are approximately similar in length a limit of three Sensecam images should be provided for each 6 second verbal statement

- Double click on the Sensecam Viewer icon to see folders of images saved
- Create a new folder in this location called "[Participant Number] Feedback".
- Double click on the folder of images of the MET required (this will be named with a date followed by the participant number and the MET number e.g. "26-September-2008 Participant 7 MET 1"
- Click on the Views menu and then on the Extra Large Icons button
- Sort through Sensecam images to find three images that can be used to represent each of the 6 second statements on the Feedback Form
- 3 images should also be used for each error statement on the Feedback Form
- Images should be picked that attempt to cover the start, middle and end of the 6 second statement
- Move selected images into the new folder that was created

Preparing the errors for feedback

- When you come to an error on the Record of Events Form type one of the following statements on the Feedback Form (corresponding to the type of error made)

Inefficiencies
Next you ___________ (what did that was inefficient). This was an error as it was inefficient and increased the amount of time you took to do the test. One of the requirements of the test was to take as little time as possible.

Rule breaks
Next you ___________ (what did that broke a rule). This was an error. One of the rules was ___________ (state rule that was broken).

Interpretation failure
Next you ___________ (what did that was a misinterpretation). This was an error. You were required to ___________ (state requirement of task that wasn't met).

Task failure
Next you ___________ (what did that allowed a task failure to occur). This was an error. You were required to do this.

Appendix 10

Scoring Form – MET-HV

Participant Number:
Group: Verbal / Sensecam
Date:

Questions before 1st MET-HV

How well would you say you know the hospital grounds?

Not at all	Somewhat	Fairly well	Very well
0	1	2	3

Questions after 1st MET-HV

How many errors in total do you think that you made?

Errors reported:

You were required to do the test in as little time as possible. Can you think of any times when you could have been more efficient?

____
____
____
____
____

Inefficiencies reported:
False positives:

There were 9 tasks that you had to do. Do you think you failed to do any of these tasks? If so, which ones?

____
____
____
____
____

Task errors reported:
False positives:

There were 9 rules that you had to follow during the task. Do you think that you failed to follow any of the rules? If so, which ones? __________ __________ __________ __________ __________ **Rule breaks reported:** **False positives:**

I gave you these instructions for the task (point to the instructions). Do you think that you misinterpreted any of the instructions? i.e you misunderstood anything about the requirements of the test? __________ __________ __________ __________ __________ **Interpretation failures reported:** **False positives:**

Actual Errors on 1st MET-HV
Inefficiencies:
Rule breaks:
Task failures:
Interpretation failures:
Total errors:

Questions after 2nd MET-HV

How many errors in total do you think that you made? **Errors reported:**

You were required to do the test in as little time as possible. Can you think of any times when you could have been more efficient? __________ __________ __________ __________ __________ **Inefficiencies reported:** **False positives:**

There were 9 tasks that you had to do. Do you think you failed to do any of these tasks? If so, which ones?

____

____

____

____

____

Task errors reported:
False positives:

There were 9 rules that you had to follow during the task. Do you think that you failed to follow any of the rules? If so, which ones?

____

____

____

____

____

Rule breaks reported:
False positives:

I gave you these instructions for the task (point to the instructions). Do you think that you misinterpreted any of the instructions? i.e you misunderstood anything about the requirements of the test?

____

____

____

____

____

Interpretation failures reported:
False positives:

Actual Errors on 2nd MET-HV
Inefficiencies:
Rule breaks:
Task failures:
Interpretation failures:
Total errors:

Time taken to do the 1st MET:
Time taken to do the 2nd MET:

Other data
Time taken to feedback about errors:
How long has the participant been at the hospital:

Appendix 11

Participant Information Sheet

Study title:

The role of visual and verbal feedback in the rehabilitation of impairments of self-awareness following Traumatic Brain Injury: An application of Sensecam

Invitation
We would like to invite you to take part in a research study. Before you decide you need to understand why the research is being done and what it would involve for you. Please take time to read the following information carefully. Talk to your keyworker or therapist about the study if you wish.

What is the purpose of the study?
The study hopes to find out more about how people who have had a brain injury can benefit from feedback about tasks that they perform in their everyday lives, for example, shopping. Previous research studies have shown that feedback can help people be aware of things that they might find difficult to do. Being aware can then help people to set goals and find ways of dealing with these difficult things in a different way. In this study we will look at two different methods of feedback – visual and verbal feedback together and verbal feedback alone. A camera that is worn around the neck called Sensecam will provide the visual part of the feedback. Sensecam takes pictures every few seconds of the area directly in front of the person wearing it. It therefore provides lots of information about what the person is doing.

Why have I been invited?
You have been invited to take part in this study because you have had a brain injury and are able to do the tasks in the research. You are also able to give me a judgement on how you think you have done on the tasks.

Do I have to take part?
No. It is entirely your choice whether or not you want to take part. Even if you do decide to take part, you can pull out at any time. I will ask you to sign a consent form to say that you want to take part. I will also ask your doctor and clinical team whether they think it is a good idea for you to take part.

What will happen to me if I take part?
The first time we meet I will ask you to do five short tests and fill in a questionnaire. This will help me to decide whether I can include you in the study. This is because I need people who have similar memory and planning skills. The questionnaire and tests I will use are:

- Wechsler Test of Adult Reading – this helps us to estimate your level of intelligence before your brain injury
- The Rivermead Behavioural Memory Test (RBMT) – this helps us to assess your memory
- List Learning – this helps us to assess your memory
- Figure Recall – this helps us to assess your memory

- The Dysexecutive Questionnaire (DEX) – this helps us assess how aware you are of your current abilities

If you do take part in the research the next stage is to undertake the task. Before this is done I will put you into one of two groups. One group will receive feedback about their performance and any mistakes on the task by being talked through the Sensecam pictures that were taken whilst they were doing the task. The other group will receive feedback by being talked through what they did in the task and where any mistakes were made. If you are in the group that only receives verbal feedback you will not wear Sensecam during the task.

The second time we meet will involve you undertaking the task. The task involves doing a number of different things such as buying things from a shop and getting information from parts of the hospital. All aspects of the task will take place in the hospital grounds and should take no longer than 1 hour.

Once you have completed this task I will meet with you a third time. During this meeting you will receive the feedback on how you have done on the task. Depending on the group you are in this will either be visual and verbal feedback together or verbal feedback alone. I will then ask you to do the same task as you did during the second meeting. This session should take no longer than 1 hour 15 minutes.

Please see the flow diagram at the back that shows the different stages involved in taking part in the research.

What will I have to do?
All you have to do is try your best on the tasks and give honest opinions of how you think you have done.

What are the possible disadvantages and risks of taking part?
There are no predicted disadvantages or risks to taking part. The feedback you receive will be no different to the type of feedback you receive on an everyday basis. However, if you feel upset in any way after any part of the research I will stop and ask whether or not you would like to take a break, or stop altogether. It is your decision to continue with the research or not. I will also make sure you receive the necessary ongoing support from someone in your team by telling your named nurse about any concerns you may have.

What are the possible benefits of taking part?
Although the study will not bring you any immediate benefits, we hope the information we get from the study may benefit some people in the long run. This knowledge could help with the design of therapy sessions and rehabilitation programmes in the future.

What will happen to the results of the research study?
The results will be written up as a thesis which will be submitted to the British Psychological Society to enable me to gain a Doctorate in Clinical Psychology, and a copy will be kept in the University of Birmingham library. It is intended that the results of the study will also be published in a scientific journal. You will not be identified in this report and all the results will be kept anonymous. At the end of the study the researcher would like to present the findings to the staff team at the rehabilitation centre and to the people who took part in the

study. If you are interested, I will send you a summary of the results once the study is completed.

What will happen if I don't want to carry on with the study?
You can choose to withdraw at any stage. With your permission, we may continue to use any information that has been obtained with your consent.

What if there is a problem?
As mentioned before, you can pull out of the study at any time. If you have a problem, concern or complaint you should contact either:

The researchers:

1) John Burns
Trainee Clinical Psychologist
University of Birmingham
School of Psychology
Edgbaston
Birmingham, B15 2TT
Tel: 0121 414 7576
Email: jmb603@bham.ac.uk

2) Dr Theresa Powell
Associate Director
Doctorate in Clinical Psychology
University of Birmingham
School of Psychology
Edgbaston
Birmingham, B15 2TT
Tel: 0121 414 7207
Email T.Powell@bham.ac.uk

3) Professor Nick Alderman
Consultant Clinical Neuropsychologist
Kemsley – St Andrews Health Care
St Andrews Hospital
Northampton
NN1 5DG
Tel. 01604616000
Email n.alderman@stah.org.uk

If you feel taking part in the study has harmed you, or you wish to make a complaint to someone who is not involved in the research study, you may wish to follow the Complaints Procedure for the hospital. You can find out about this by asking any member of staff.

Will my taking part in the study be kept confidential?
Yes. All information about you will be handled in confidence and kept in a locked cabinet in one of the offices in this building. Any information that is entered onto a computer will be entered in such a way that your name can not be linked with the information. The computer will also be password protected meaning that only I will be able to access it. You name and personal details will not be mentioned anywhere in the study in order to protect your identity.

Your Responsible Medical Officer will be informed of your participation in the study. They will not be given access to your individual results but will be able to access a summary of the results of the study. However, this information will not contain any of your personal details.

The researchers may also access the medical records that are kept about you by St Andrews Hospital. This may be done if further information about the consequences of your injury is required.

Who is organising and funding the research?
The University of Birmingham is covering the costs of this research study.

Who has reviewed the study?
All research in the NHS is looked at by an independent group of people, called a Research Ethics Committee to protect your safety, rights, wellbeing and dignity. This study has been reviewed and approved by Leicestershire, Northamptonshire and Rutlands Ethics Committee.

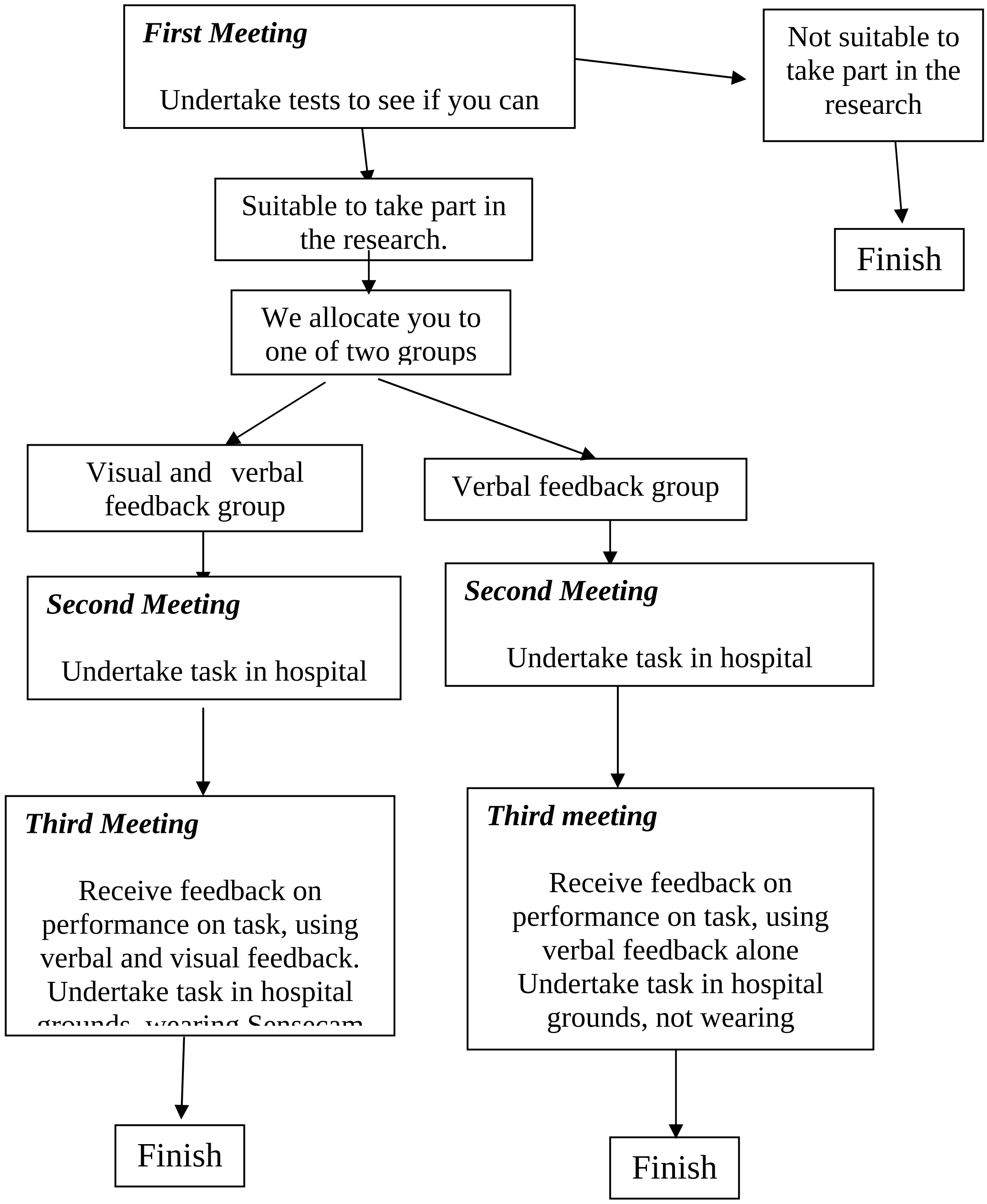
Further information and contact details

Further information about the study can be obtained from:

The researcher:
John Burns
Trainee Clinical Psychologist
University of Birmingham
School of Psychology
Edgbaston
Birmingham, B15 2TT
Tel: 0121 414 7576
Email: jmb603@bham.ac.uk

The research supervisor:
Dr Theresa Powell
Associate Director
Doctorate in Clinical Psychology
University of Birmingham
School of Psychology
Edgbaston
Birmingham, B15 2TT
Tel: 0121 414 7207
Email T.Powell@bham.ac.uk

Diagram showing what will happen if you agree to take part in the research



Appendix 12

Client consent form

Title of Project: The role of visual and verbal feedback in the rehabilitation of impairments of self-awareness following Traumatic Brain Injury: An application of Sensecam

Name of Researcher: John Burns	**Please initial box**
I confirm that I have read and understand the information sheet dated May 2008 (version 2.0) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily	☐
I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.	☐
I understand that the researcher will discuss my participation with my Responsible Medical Officer and may access my case notes. I give permission for these discussions to take place and for the researcher to have access to my records.	☐
I agree to take part in the above study.	☐

Name ___________________________ Signature________________ Date_______________

Researcher_______________________ Signature____________________________ Date___

Client Consent Form: May 2008 Version 2.0

Appendix 13

Letter to RMO

Dear [name of RMO]

My name is John Burns and I am currently undertaking a Doctorate in Clinical Psychology at Birmingham University. I am writing to you as I will be undertaking some research in Kemsley Division under the supervision of Professor Nick Alderman.

The study hopes to find out more about how people who have had a brain injury can benefit from feedback about their performance on an executive functioning task. Specifically we would like to see how different forms of feedback improve self-awareness and performance on the task. We will be looking at two forms of feedback – verbal feedback and visual and verbal feedback together. Visual feedback will be provided by Sensecam, which is a new wearable camera that has been developed by Microsoft.

I am looking for participants who have elements of dysexecutive syndrome, are English speaking and are able to give informed consent. A full list of the inclusion and exclusion criteria can be found in the attached Research Protocol document.

I have asked your colleagues in the Psychology department to think about some patients within Kemsley that may be suitable to undertake the research. Once this list has been put together I will come back to you to ask your permission to approach these patients.

I look forward to speaking to you more about this in the future,

Yours sincerely

John Burns
Trainee Clinical Psychologist