



AOTA Critically Appraised Topics and Papers Series
Traumatic Brain Injury

**A product of the American Occupational Therapy Association's
Evidence-Based Literature Review Project*

CRITICALLY APPRAISED PAPER (CAP)

Focused Question

What is the evidence for the effect of interventions to address cognitive/perceptual functions (attention, memory, executive functions) on the occupational performance for persons with traumatic brain injury (TBI)?

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Manly, T., Hawkins, K., Evans, J., Woldt, K., & Robertson, I. H. (2002). Rehabilitation of executive function: Facilitation of effective goal management on complex tasks using periodic auditory alerts. *Neuropsychologia*, 40, 271–281.

PROBLEM STATEMENT (JUSTIFICATION OF THE NEED FOR THE STUDY)

State the problem the authors are investigating in this study.

The 'dysexecutive syndrome' represents a major challenge to functional recovery and adaptation following brain injury. Although IQ may remain well above average, in daily life patients have profound difficulties in achieving useful goals. Previous reports of everyday difficulties, and performance on complex, life-like tasks, indicate that an adequately represented goal may become neglected as patients become overly engaged in current activity. To date, few systematic attempts to remediate dysexecutive disorders have been reported.

RESEARCH OBJECTIVE(S)

List study objectives.

Examine whether the provision of brief auditory stimuli, acting to interrupt current activity and cue patients to consider their overall goal, would improve performance in a complex task. This method uses general environmental manipulation to support residual executive function and overcome the dissociation between knowledge and action demonstrated by these patients. Specifically, the researchers examined whether the patients' ability to evaluate, plan, and change track can be supported by engineering brief interruptions in their current activity and using these as a reminder to the patient to consider their current behavior and goals.

The research questions were:

- 1) Would 10 patients with traumatic brain injury (TBI) who experience difficulties in everyday complex situations perform more poorly than age-, sex-, and IQ-matched controls on a modification of the Six Elements task?
- 2) Would provision of brief auditory alerting tones during performance facilitate a closer link between patients' stated task plan and their actions?

Describe how the research objectives address the focused question.

The study examines an intervention that aims at improving occupational performance of persons with deficient executive function secondary to TBI.

DESIGN TYPE:

One group, repeated measures crossover design; randomly assigned to condition and version of test to start

Level of Evidence:

I

Limitations (appropriateness of study design):

Was the study design type appropriate for the knowledge level about this topic? *If no, explain.*

Yes

No

SAMPLE SELECTION

How were subjects selected to participate? Please describe.

Inclusion Criteria

Score below mean for the Six Elements subtest of the Behavioral Assessment of the Dysexecutive Syndrome (BADSD); evidence of "acquired disorganization" in everyday life based on the opinions of relatives and clinicians working with the patients.

Exclusion Criteria

Patients with previous neurological illness or head injury resulting in loss of consciousness became control subjects

Sample Selection Biases: *If yes, explain.*

Volunteers/Referrals

Yes subjects were volunteers from rehabilitation centers

No

Attention

Yes

No

Others (list and explain):

SAMPLE CHARACTERISTICS

N = 10 brain injury (BI) 24 volunteer controls. TBI group mean age = 32.1 years; all > 1 yr. posttrauma; mean current IQ Wechsler Adult Intelligence Scale – Revised (WAIS-R) = 97.2. Control: 18 men, 6 women; mean age = 29.29 years; estimated full scale IQ (National Adult Reading Test) = 102.04. Control group apparently used only to determine standard time requirements for the test.

% Dropouts

(%) Male

(%) Female

Ethnicity

Disease/disability diagnosis

NR = Not reported.

Check appropriate group:

<20/study group <input checked="" type="checkbox"/>	20–50/study group	51–100/study group	101–149/study group	150–200/study group
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Sample Characteristics Bias: If no, explain.

If there is more than one study group, was there a similarity between the groups?

Yes They had 2 groups but the groups were not used as 2 study groups. The control group was used to establish “normal” standards for time required to finish tasks. There was no significant difference in sex distribution ($\chi^2 = 0.97$, $p = 0.324$) or age ($F_{[1,33]} = 0.09$, $p = 0.76$); IQ ($F_{[1, 33]} = 0.95$, $p = 0.34$) between the control and TBI groups.

No

Were the reasons for the dropouts reported?

Yes

No

INTERVENTION(S)—Included are only those interventions relevant to answering the evidence-based question.

Add groups if necessary

Two conditions used. TBI patients randomly assigned to treatment versus control condition and to Version A or Version B of the test. Time elapsed between administrations was 1 week.

Group 1: Treatment condition: Alerting Version A or B

Brief Description	Hotel Task as described below administered under an alerting condition. The 35 milliseconds (ms) alert was delivered by a Sony portable tape player at 60 decibels. Alerts were given at the following minute and second intervals: 2'14", 5'11", 8'18", 9'59", 11'25", and 13'44". Subjects were instructed to pretend to be applying to work in a hotel. The manager wanted them to do part of all 6 tasks over the next 15 minutes to get a feel for them, although none of the tasks could be completed in the 15 minute period. "The most important thing is to try to do something from each task—spending as much time on each as possible within the total time available." The details of each task were then described and a written summary was placed next to the relevant materials for each task. The instructions intimated that performance within each task would be scrutinized in order to encourage a reasonable degree of commitment to each task. They were told the tape recorder would beep from time to time and that they might find it useful to remind them to think about what they are currently doing and their overall aims during the session.
Setting	Laboratory
Who Delivered?	Examiner
Frequency?	Once
Duration?	15 min

Group 2 Control condition: tasks without alerting Version A or B

Brief Description	Same as above without alerting; used a different version of the test
Setting	Same as above
Who Delivered?	Same as above
Frequency?	Same as above
Duration?	Same as above

Intervention Biases: Explain, if needed.

Contamination

Yes

No

Co-intervention

Yes

No

Timing

Yes

No

Site

Yes

No

Use of different therapists to provide intervention

Yes

No

MEASURES AND OUTCOMES—Included are measures relevant to answering the focused question.

Name of measure:

Modification of Shallice and Burgess' Six Elements task¹. In the "Hotel" test, the participants were asked to try to do some of each of 5 subtasks within 15 minutes. If all tasks were to be completed by a neurologically healthy person, the test would require over an hour.

Version A: The Hotel task comprised 6 distinct activities that would plausibly need to be completed in the course of running a hotel: compiling 8 individual bills of 10 services each from the till roll; sorting the charity collection of 196 coins, distinguishing British coins from foreign; looking up telephone numbers for a list of 34 companies using the Yellow Pages; sorting conference labels of 100 conference participants into alphabetical order; proofreading the 9-page hotel leaflet for double-letter spelling mistakes; and opening and closing the garage doors at 2 predefined times to allow deliveries.

¹ Shallice, T., & Burgess, P. (1991). Deficit in strategy application following frontal lobe damage in man. *Brain*, 114, 727-741.

Version B: A parallel set of materials for the compiling bills, looking up phone numbers, and proofreading tasks were developed for the second administration of the test. Times for opening and closing the garage doors were changed.

Outcome(s) measured (what was measured?):

Ability of the participant to engage and break away from tasks to engage in another task. Number of times the clock was consulted and the start and stop times of each task were recorded.

Scores:

- 1) Number of tasks attempted—1 point each for maximum of 5 points;
- 2) Time allocation—Deviations in seconds from ideal allocation of 3 minutes per task;
- 3) Pressing the garage door buttons—1 point for pressing each of the open or close button;
- 4) 4) Garage door time deviations—Deviations from the correct times to press the buttons was calculated in seconds and converted into 4 scores: 4 = within 60 seconds of appointed time; 3 = between 60 and 120 seconds; 2 between 120 and 180 second; 1 for > 180 seconds. Failure to push at all = 0.

Is the measure reliable (as reported in article)?

Yes

No

NR evaluating for practice effects between first and second test (whether Version A or B) by the control group indicated no significant difference in the parameters being measured.

Is the measure valid (as reported in article)?

Yes

No

NR

How frequently was the measure used for each group in the study?

N/A

Measurement Biases

Were the evaluators blinded to treatment status? *If no, explain.*

Yes

No

NR Probably not

Recall or memory bias *If yes, explain.*

Yes

No two versions of the test were constructed and participants were assigned randomly to version A or B. No significant differences between versions (Wilcoxon Rank Sum = 143.0, $p = 0.78$) as determined from control group performance.

Others (list and explain):

No practice effects as determined by control group performance.

Limitations (appropriateness of outcomes and measures) *If no, explain.*

Did the measures adequately measure the outcome(s)?

Yes

No

RESULTS

List results of outcomes relevant to answering the focused question Include statistical significance where appropriate ($p < 0.05$)

Include effect size if reported NR, but calculated from data.

In the control condition, the TBI group started a mean of 4.1 tasks (S.D. = 0.88) versus 4.8 tasks (S.D. = 0.42) in the alerted condition, a significant improvement ($F_{(1,9)} = 5.44$, $P < 0.05$), $r = .61$)
Time deviation from optimal time allocation: Control = 582.50 s (S.D. = 247.9); Alerted = 328.90 s (S.D. = 184.6), a significant improvement ($F_{(1,9)} = 15.22$, $p < 0.01$, $r = .79$).
Total time in activity = NS difference between conditions ($F_{(1,9)} = 0.51$, $p = 0.5$, $r = .23$)
Time specific responses (garage door): NS between conditions ($F_{(1,9)} = 1.05$, $p = 0.33$, $r = .32$)
Use of the clock: NS between conditions.
Response to tone: The alert did not prompt a switch in tasks ($F_{(1,9)} = 0.47$, $p = 0.51$, $r = .22$)

Was this study adequately powered (large enough to show a difference)? *If no, explain.*

Yes

No generally it was, but for the key finding of task switch after alert and for scores of total time in activity and time specific responses, the effect was small to medium, and with a greater N , may have reached significance between conditions.

Were appropriate analytic methods used? *If no, explain.*

Yes

No

Were statistics appropriately reported (in written or table format)? *If no, explain.*

Yes

No

CONCLUSIONS

State the authors' conclusions that are applicable to answering the evidence-based question.

The performance of patients was significantly improved when exposed to periodic, non-predictive tones. On two variables (number of tasks attempted, time allocated to tasks), performance was not significantly different from the control group. These results cannot be accounted for by the use of auditory alerts. There is little evidence that the alerting tone acted to promote an immediate task switch regardless of where the individual 'was' in a task. Participants reported the tone to be annoying.

Were the conclusions appropriate for the study design (level of evidence)? *If no, explain.*

Yes

No

Were the conclusions appropriate for the statistical results? *If no, explain.*

Yes

No

Were the conclusions appropriate given the study limitation and biases? *If no, explain.*

Yes

No

IMPLICATIONS FOR OCCUPATIONAL THERAPY

This section provides guidance about clinical practice, program development, and other implications of the study findings as they relate to the focused question.

The implications for occupational therapy are that the use of alerting tones did not interrupt ongoing behavior and focus the patient onto a different task; therefore, this intervention would not be one an occupational therapist would choose to use with patients with brain injuries.

There are two other bits of information that are applicable to occupational therapy: a) good information regarding occupational performance can be obtained from simulated “real-life” assessments, which is common to our practice; and b) the improvement in performance (number of tasks attempted within a time limit and improvement in time allocation to tasks) may have occurred due to practice. Although the researchers took care to control for practice effects of testing by changing the versions of the test for the two administrations, they only changed the content of the tasks (e.g., different lists), but not the process. Practice with the process may have enabled the participants to improve regardless of the particular requirements. It is important for occupational therapists to know this because it would support therapeutic use of practice of various processes involved in a task with varying particular requirements to generalize patient behavior. Occupational therapists need to study this further under controlled conditions.

This work is based on the evidence-based literature review completed by Catherine Trombly, ScD, OTR/L, FAOTA.

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