Cognitive stimulation therapy (CST): neuropsychological mechanisms of change

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ABSTRACT

Background: Cognitive stimulation therapy (CST) is an evidence-based psychosocial intervention for people with dementia consisting of 14 group sessions aiming to stimulate various areas of cognition. This study examined the effects of CST on specific cognitive domains and explored the neuropsychological processes underpinning any effects.

Methods: A total of 34 participants with mild to moderate dementia were included. A one-group pretest–posttest design was used. Participants completed a battery of neuropsychological tests in the week before and after the manualised seven-week CST programme.

Results: There were significant improvement pre- to post-CST group on measures of delayed verbal recall (WMS III logical memory subtest – delayed), visual memory (WMS III visual reproduction subtest – delayed), orientation (WMS III information and orientation subscale), and auditory comprehension (Token Test). There were no significant changes on measures of naming (Boston Naming Test-2), attention (Trail Making Test A/Digit Span), executive function (DKEFS verbal fluency/Trail Making Test B), praxis (WMS III visual reproduction – immediate) or on a general cognitive screen (MMSE).

Conclusions: Memory, comprehension of syntax, and orientation appear to be the cognitive domains most impacted by CST. One hypothesis is that the language-based nature of CST enhances neural pathways responsible for processing of syntax, possibly also aiding verbal recall. Another is that the reduction in negative self-stereotypes due to the de-stigmatising effect of CST may impact on language and memory, domains that are the primary focus of CST. Further research is required to substantiate these hypotheses.

Key words: Alzheimer’s disease, dementia, cognition, memory, language

Introduction

Cognitive stimulation for people with dementia

In recent years, there has been growing interest in a number of cognition-focussed psychological interventions for the treatment of mild to moderate dementia (e.g. Clare and Woods, 2004). These interventions are based on the rationale that people in the earlier stages of dementia can learn and be rehabilitated (Clare et al., 2000). One such intervention, cognitive stimulation, has been defined by Clare and Woods (2004) as “engagement in a range of group activities and discussions aimed at general enhancement of cognitive and social functioning” (p. 387).

The central assumption underlying cognitive stimulation is that a lack of cognitive stimulation can hasten decline in both normal aging and dementia (Salthouse, 2006). Support for this assumption comes from increasing evidence that activation of neurons may enhance neuronal function and survival (Swaab et al., 2002).

An evidence-based group cognitive stimulation therapy (CST) programme was developed and evaluated in a large multicentre, single-blind, randomised controlled trial (RCT; Spector et al., 2003). A significant benefit was found for the treatment group compared with the treatment as usual control group in two measures of cognitive function: the Mini-Mental State Examination (MMSE; Folstein et al., 1975) and the cognitive subscale of the Alzheimer’s Disease Assessment Scale (ADAS–Cog; Rosen et al., 1984). In addition,
the authors found benefits to quality of life and showed that these were mediated by the improvements in cognition (Woods et al., 2006). On the basis of this trial, the National Institute for Health and Clinical Excellence–Social Care Institute for Excellence (NICE-SCIE) in the United Kingdom recommended structured group CST as the non-pharmacological treatment of choice for the cognitive symptoms of mild to moderate dementia of all types (NICE-SCIE, 2007).

A recent Cochrane review of cognitive stimulation (Woods et al., 2012) concluded that there is strong evidence that cognitive stimulation has a positive impact on cognitive function, depression, activities of daily living, and behaviour for people with dementia, over and above any medication effects.

Despite strong evidence that cognitive stimulation leads to generalised cognitive benefits, very few studies to date have looked at its impact on specific areas of cognition. Most have looked only at generic cognitive change on brief measures such as the MMSE and ADAS-Cog (Woods et al., 2012). Little is currently known about whether some aspects of cognition change more than others and why.

Only two trials of cognitive stimulation to date have examined neuropsychological outcomes in depth. Participants in Breuil et al. (1994) completed the Consortium to Establish a Registry for Alzheimer’s Disease (CERAD) neuropsychological test battery (Morris et al., 1989) together with an additional battery of three tests: a picture pair associate test, an immediate associate test, and a further test of verbal fluency. Alongside a statistically significant improvement in MMSE scores, they found a non-significant trend towards improvement on the CERAD word list memory task and on one of the “association” tests. They did not find any change in verbal fluency and they discarded the remaining five items of the CERAD battery due to ceiling and floor effects. The authors concluded that cognitive stimulation appears to induce increased memory performance; however, they did not speculate on the possible mechanisms for this change.

Spector et al. (2010) investigated the effects of their CST programme on specific areas of cognition, by analysing the three subscales of the ADAS-Cog (memory and new learning, praxis, and language) using the data from their RCT (Spector et al., 2003). They found a statistically significant improvement in the language subscale in the treatment group compared with the control group, with statistically significant improvements found on the “commands” and “spoken language” items. There were no significant changes in praxis and, in contrast to Breuil et al.’s (1994) findings, there were no changes in memory and new learning. The authors concluded that CST appears to have particular effects in promoting language.

In terms of mechanisms of change, Spector et al. (2010) suggested that this could be through generating opinions and creating new semantic links through categorisation, and that through encouragement of expression of views and opinions, CST may improve conversation and communication. They suggested that this may have generalised benefits, helping to explain why improvements in quality of life were mediated by changes in cognition.

Limitations of current findings
The frequent use of brief screening tools in research trials, such as the MMSE and ADAS-Cog, has limited the evaluation of cognitive outcomes to date. The ADAS-Cog is a research tool as opposed to a clinical tool and does not assess cognitive domains in any depth. It has been widely recognised as suboptimal with respect to the measurement of some areas of cognition that are often compromised in dementia including attention, planning, working memory, and executive function (Mohs et al., 1997). Three language items are rated through the assessor’s subjective observations and it lacks sensitivity for measuring cognitive change in patients with mild dementia.

Aims and objectives
This study aimed to investigate the effects of the CST programme of Spector et al. (2003) on specific areas of cognition in depth, using more objective, sensitive, and detailed neuropsychological testing. It aimed to address the following questions:

- Which cognitive domains show improvement in people with dementia following participation in group CST?
- Which neuropsychological processes might underpin these changes?

Method
Participants and settings
Sampling strategy
Services running CST groups for people with dementia were identified by contacting professionals who had attended a CST training workshop. Of these 100 services, eight agreed to participate. These services consisted of two National Health Service (NHS) memory clinics, three NHS day hospitals, and three local authority day centres.

Group facilitators identified potential participants through the usual CST group recruitment
neuropsychological mechanisms of change in CST

Processes within each service. Potential participants and their family caregiver(s), when possible, were then contacted to discuss the study further and to arrange an appointment to provide written informed consent, be screened for suitability, and complete the pre-group assessment.

**INCLUSION CRITERIA**

These followed the criteria outlined by Spector et al. (2003). People were considered suitable for participation in the study if they:

(a) Had been given a diagnosis of dementia;
(b) Had mild to moderate dementia (MMSE score of 10 or more);
(c) Had some ability to communicate and understand communication;
(d) Had English as their first language or had sufficient English to complete the neuropsychological tests validly;
(e) Were able to see and hear well enough to participate in the group and complete the neuropsychological tests;
(f) Did not have a learning disability;
(g) Did not have a major physical illness or disability which would significantly limit their participation in the group;
(h) Were not too impaired to understand the nature of the study.

**SAMPLE SIZE**

A power analysis was conducted using the G*Power 3 computer program (Faul et al., 2007). Using the results from Spector et al. (2003), it was estimated that a sample size of 42 was required to achieve 80% power to detect an effect size of 0.31 using a within group t-test with a 0.05 (two-tailed) level of significance.

In the eight participating services, group facilitators identified a total of 74 people who were interested in taking part in a CST group. Of these, 46 were screened, 41 entered the study and, of these, 34 completed both a pre-group and post-group assessment (Figure 1).

**DEMOGRAPHICS OF FINAL SAMPLE**

The final sample of 34 participants consisted of 14 males and 20 females who were either white British (n = 32) or white European (n = 2) and were aged between 57.7 and 92.7 years (M = 80.3, SD = 8.8). The majority of the sample were given a diagnosis of dementia unspecified (n = 12). The remainder had been diagnosed with Alzheimer’s (n = 8), vascular dementia (n = 7), mixed dementia (n = 5), fronto-temporal dementia (n = 1), and dementia with Lewy bodies (n = 1). Regarding severity of cognitive impairment, baseline MMSE scores ranged from 10 to 29 (M = 20.3, SD = 5.1). The majority of participants reported leaving education after high school (n = 25), some reported attending technical college (n = 6), and a small number reported attending university (n = 3). Approximately half of the participants (n = 16) were taking anti-dementia medication (cholinesterase inhibitors) at the commencement of the study, with most taking donepezil (n = 14), one participant taking galantamine, and one participant taking rivastigmine. Information regarding the length of time participants had been taking cholinesterase inhibitors was available for 11 participants and ranged from 1.6 to 35.9 months (M = 11.2, SD = 11.5). Only one participant had been taking anti-dementia medication for less than two months.

**Ethics**

The appropriate multi-centre and local research ethics committees granted ethical approval. Only people able to provide informed consent were included. A caregiver (either a member of staff or a family member) was asked to witness the informed consent process whenever possible.

**Research design and procedure**

The study used a one-group pretest–posttest design. Participants completed a neuropsychological test battery (Table 1), which took approximately 1–1.5 hours in the week prior to and the week following CST. All assessments were conducted strictly according to test instructions and tests were administered in the same order for each participant.

**Intervention**

The 14-session (two 45-minute sessions per week over seven weeks) manualised CST programme

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| People who agreed to take part in a CST group (n = 74) |
| People who agreed to be screened by researcher (n = 46) |
| People Included (n = 41) |
| People excluded (n = 5) |
| Too hearing impaired: 1 |
| Too visually impaired: 1 |
| Unable to consent: 1 |
| Too physically ill: 1 |
| Drop outs (n = 7) |
| Became distressed during initial assessment: 2 |
| Died before follow-up: 1 |
| Refused follow-up: 1 |
| Too physically ill at follow-up: 3 |
| Completed study (n = 34) |

Figure 1. Profile of attrition.
<table>
<thead>
<tr>
<th>TEST</th>
<th>AUTHOR(S)</th>
<th>BRIEF DESCRIPTION OF TEST</th>
<th>SCORE(S)</th>
<th>PRIMARY COGNITIVE DOMAIN(S) ASSESSED</th>
</tr>
</thead>
<tbody>
<tr>
<td>WMS-III Information and Orientation</td>
<td>Wechsler (1997)</td>
<td>Participants answer a series of questions regarding orientation to time and place and personal and general knowledge.</td>
<td>Total score</td>
<td>Orientation</td>
</tr>
<tr>
<td>WMS-III Logical Memory</td>
<td>Wechsler (1997)</td>
<td>Participants recall two short stories read aloud by the examiner both immediately and after a 25–35 minute delay. A yes/no recognition task follows delayed recall.</td>
<td>LMI Recall (immediate recall)</td>
<td>Memory: Verbal episodic learning, recall, and recognition</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LMI Thematic (immediate thematic recall)</td>
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<td></td>
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<td>LMII Recall (delayed recall)</td>
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<td></td>
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<td></td>
<td>LMII Thematic (delayed thematic recall)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>LMII Recognition (delayed recognition)</td>
<td></td>
</tr>
<tr>
<td>WMS-III Visual Reproduction</td>
<td>Wechsler (1997)</td>
<td>Participants look at geometric figures for 10 seconds and then reproduce them from memory. Participants are asked to reproduce the figures from memory after 25–35 minutes and then recognise which figures they have seen before. In addition, participants are asked to simply copy the line drawings.</td>
<td>VRI Recall (immediate recall)</td>
<td>Memory: Visual episodic learning, recall, and recognition</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VRIII Recall (delayed recall)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>VRIII Recognition (delayed recognition)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>VRIII Copy</td>
<td></td>
</tr>
<tr>
<td>WMS-III Digit Span</td>
<td>Wechsler (1997)</td>
<td>Pairs of random number sequences of increasing length are read aloud at the pace of one per second. In the digit span forwards subtest participants are required to repeat each sequence exactly as it is given. In the backwards subtest, participants are asked to repeat the sequence in reverse order. Literature does not support a conceptual distinction between forwards and backwards digit span (Strauss et al., 2006).</td>
<td>Total score</td>
<td>Auditory Working Memory</td>
</tr>
<tr>
<td>Boston Naming Test-2 (BNT-2)</td>
<td>Kaplan et al. (2001)</td>
<td>Participants name a series of drawings of objects that are graded in terms of their familiarity.</td>
<td>Total correct</td>
<td>Language Expression: Naming</td>
</tr>
<tr>
<td>Test</td>
<td>Reference</td>
<td>Description</td>
<td>Subtests</td>
<td></td>
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<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
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<tr>
<td>D-KEFS Verbal Fluency</td>
<td>Delis et al. (2001)</td>
<td>Participants begin by saying as many words as they can that begin with a specified letter (Letter Fluency) within one minute. Participants are then asked to say as many words as they can that belong to a designated semantic category (Category Fluency). Participants are then asked to switch between saying items from two semantic categories (Category Switching).</td>
<td>Letter fluency total correct Category fluency total correct Category switching accuracy</td>
<td></td>
</tr>
<tr>
<td>Trail Making</td>
<td>Reitan and Wolfson (1992)</td>
<td>This test consists of two parts labelled A and B. Trail Making A consists of 25 consecutive numbered circles that participants connect by drawing a line through each element in the series. Trail Making B is a more complex task in which a series of numbers (1–13) and letters (A–L) are presented on the page within circles. Participants are required to work through the entire set alternately connecting numbers and letters as rapidly as possible.</td>
<td>Time taken to complete Trails A Time taken to complete Trails B</td>
<td></td>
</tr>
</tbody>
</table>

*Note. WMS-III: Wechsler Memory Scale 3rd edn; D-KEFS: Delis-Kaplan executive function system.*
was followed (Spector et al., 2006). Themed sessions involve topics including word association, object categorisation, current affairs, and famous faces. The programme follows “key principles” including implicit rather than explicit learning (with a focus on information processing rather than factual knowledge), multisensory stimulation, reminiscence to aid orientation and creating continuity between sessions.

In each service, the CST programme was facilitated by one or more people (e.g. care worker, nurse, occupational therapist or assistant psychologist) who had attended a CST training workshop. Facilitators were asked to complete an adherence checklist of the key principles of CST after each session.

Measures

**Screening tool**
Mini-Mental State Examination (MMSE; Folstein et al., 1975). This brief, widely used test of cognitive function was used to determine the level of severity of dementia. It was also re-administered at follow-up in order to make comparisons with the findings of the original Spector et al. (2003) RCT. The MMSE has good reliability and validity.

**Rationale for selection of cognitive domains and neuropsychological tests**
The following cognitive domains were assessed, being areas that tend to become impaired in dementia according to Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) criteria (APA, 2000):

- Orientation
- Attention/working memory
- Memory (verbal and non-verbal)
- Language (expression and comprehension)
- Executive function
- Praxis

All neuropsychological tests selected for the battery (see Table 1) were considered suitable for assessing older people, had age appropriate norms (Clare, 2008), had good reliability, validity, and sensitivity and had a relative lack of ceiling and floor effects in mild to moderate dementia. A primary measure was identified for each cognitive ability (referencing Strauss et al., 2006). As some measures generate several scores assessing different aspects of cognition, only the most relevant scores were calculated and analysed (Table 1). Further considerations were that the total battery should take no longer than 1.5 hours to administer, minimizing burden on participants; and that the key cognitive functions assessed should overlap minimally in order to reduce redundancy. Additionally, the Wechsler Test of Adult Reading (WTAR; Wechsler, 2001) was administered to provide an estimate of premorbid intellectual functioning.

**Data analysis**
Data were analysed using SPSS version 17.0. Several distributions had statistically significant levels of skewness and kurtosis at the 0.01 level. For these variables, a non-parametric two-tailed Wilcoxon test was used instead of paired t-tests to examine within-participant changes post-CST at the 0.05 level. Severity of impairment (baseline MMSE score) between completers and non-completers was examined.

**Results**
Of the 39 participants at baseline, 34 completed a follow-up assessment (Figure 1). One or more of the tests were not completed at baseline, follow-up, or both by 12 participants due to refusal, fatigue, or difficulty retaining task instructions. The number of participants who completed each test at each stage is reported in Table 2. The mean baseline MMSE score of the 22 participants who completed every test at both pre- and post-group assessment (M = 22.32, SD = 4.05) was significantly higher than that of the 12 participants who did not complete one or more items (M = 16.58, SD = 4.80) (t(32) = 3.67, p = 0.001).

The mean number of sessions attended by participants was 13.1 (SD = 1.7, range 6–14) and 85% of participants (n = 29) attended 13 or 14 sessions. Across the eight participating services, 14 CST groups were run in total with between four and seven participants in each CST group.

**Adherence to key principles**
Adherence checklists were completed and returned by four of the participating services for four out of the 14 CST groups. Within these, the percentage adherence to the key CST principles across all 14 of the CST sessions ranged from 85% to 100% (M = 94.15, SD = 6.37).

**Floor and ceiling effects**
No ceiling effects were found on any of the measures used; however, there were large floor effects on the Trail Making B test, delayed recall variable (LMII Recall) of the WMS-III Logical Memory test, and the two WMS-III delayed recognition variables (LMII Recognition and VRII Recognition).
Premorbid intellectual functioning
The WTAR was completed by 33 of the 34 participants, with one participant having lost the ability to read. Although the WTAR is relatively resistant to brain damage (Strauss et al., 2006), the performance of several participants (e.g. those with more significant language difficulties) may have been significantly affected by their cognitive impairments. Hence, the mean standard score of 93.73 (SD = 21.58) may have been somewhat of an underestimate.

MMSE and orientation
There was no statistically significant change over time on the MMSE (Table 2). There was a significant improvement in scores on the WMS-III Information and Orientation test at follow-up compared to baseline (Table 2).

Memory
In terms of verbal memory, there was a significant improvement on the immediate and delayed thematic recall variables of the WMS-III Logical Memory test at the 0.05 level (Table 2). Trends towards statistical significance were also found on the delayed recall and recognition variables but not on the immediate recall variable (Table 2).

A significant improvement over time was also found on the delayed recall variable of the WMS-III Visual Reproduction test (Table 2) which measures visual memory. No significant changes were found on the immediate recall or recognition variables (Table 2).

Attention/working memory
A trend towards a statistically significant decline was found on the total score of the WAIS-III Digit Span subtest, which is a measure of attention/working memory (Table 2). There was no significant change over time on the Trail Making A test which is also a measure of attention (Table 2).

Language
In terms of language comprehension, a significant improvement over time was found on the Token Test (Table 2). This test is a measure of auditory comprehension of commands. With regard to language expression, there were no statistically significant changes on measures of naming (BNT-2) or verbal fluency (D-KEFS) over time (Table 2).

Executive function
There were no significant changes over time on the D-KEFS verbal fluency switching task, which assesses cognitive flexibility. The Trail Making B test, which also measures this domain, suffered from large floor effects with only five participants able to complete this task at both pre-group and post-group assessments. The results for this measure were therefore not analysed.

Praxis
Praxis was assessed using the “copy” component of the WMS-III Visual Reproduction test. There were no significant changes over time on this measure (Table 2).

Discussion
Main findings
The findings of this study suggest that memory, language comprehension, and orientation may be the cognitive domains most amenable to improvement in people with mild to moderate dementia who participate in group CST. The results also indicate that CST may not have an impact on the cognitive domains of attention/working memory, executive function, or praxis.

Comparison with previous findings
Overall, these findings are consistent with the conclusion that cognitive stimulation can have a positive impact on cognitive function (Woods et al., 2012). Furthermore, the findings are partially consistent with those of Spector et al. (2010) that language is the domain most influenced by cognitive stimulation. The improvement in language comprehension found in the current study is commensurate with Spector et al.’s finding of an improvement in the ability to follow commands. On the contrary, no statistically significant improvements were found on two measures of language expression (naming and fluency) whereas Spector et al. found an improvement in spoken language.

In contrast to the current findings, Spector et al. (2010) found no changes in memory and concluded that this was consistent with the approach of cognitive stimulation which does not emphasise explicit rehearsal of information. On the other hand, an improvement in memory is consistent with Breuil et al.’s (1994) finding of a trend towards improvement on two measures of memory.

A further discrepancy between the current findings and the findings of previous studies is that both Spector et al. (2003) and Breuil et al. (1994) found a statistically significant improvement on the MMSE, whereas no improvements were found on this measure of general cognitive function in the current study.
<table>
<thead>
<tr>
<th>MEASURE</th>
<th>n</th>
<th>MEAN SCORE AT BASELINE M (SD)</th>
<th>MEAN SCORE AT FOLLOW-UP M (SD)</th>
<th>MEAN CHANGE FROM BASELINE M (SD)</th>
<th>t(df) OR WILCOXON Z</th>
<th>SIG. (2-TAILED)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMSE</td>
<td>34</td>
<td>20.29(5.08)</td>
<td>20.41(5.09)</td>
<td>+0.12(2.43)</td>
<td>0.28(33)</td>
<td>0.780</td>
</tr>
<tr>
<td>WMS-III Information and Orientation</td>
<td>34</td>
<td>8.38(2.87)</td>
<td>9.06(2.52)</td>
<td>+0.68(2.72)</td>
<td>1.45(33)</td>
<td>0.003*</td>
</tr>
<tr>
<td>WMS-III Logical Memory</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>LMI Recall</td>
<td>34</td>
<td>8.79(8.29)</td>
<td>9.59(9.54)</td>
<td>+0.79(3.97)</td>
<td>1.17(33)</td>
<td>0.252</td>
</tr>
<tr>
<td>LMI Thematic</td>
<td>34</td>
<td>4.59(4.55)</td>
<td>5.88(5.55)</td>
<td>+1.29(3.33)</td>
<td>2.27(33)</td>
<td>0.030*</td>
</tr>
<tr>
<td>LMII Recall</td>
<td>34</td>
<td>1.71(2.55)</td>
<td>2.59(3.88)</td>
<td>+0.88(2.82)</td>
<td>−1.80</td>
<td>0.071¹</td>
</tr>
<tr>
<td>LMII Thematic</td>
<td>34</td>
<td>1.15(2.00)</td>
<td>2.00(2.91)</td>
<td>+0.85(2.22)</td>
<td>−2.14</td>
<td>0.032*</td>
</tr>
<tr>
<td>LMII Recognition</td>
<td>29</td>
<td>18.17(3.04)</td>
<td>19.62(2.94)</td>
<td>+1.45(3.84)</td>
<td>2.03(28)</td>
<td>0.052¹</td>
</tr>
<tr>
<td>WMS-III Visual Reproduction</td>
<td></td>
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<td></td>
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<tr>
<td>VRI Recall</td>
<td>33</td>
<td>26.27(17.11)</td>
<td>27.03(19.24)</td>
<td>+0.76(13.69)</td>
<td>0.32(32)</td>
<td>0.753</td>
</tr>
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<td>VRII Recall</td>
<td>33</td>
<td>1.94(5.02)</td>
<td>4.70(9.14)</td>
<td>+2.76(6.94)</td>
<td>−2.20</td>
<td>0.028*</td>
</tr>
<tr>
<td>VRIII Recall</td>
<td>29</td>
<td>31.17(4.55)</td>
<td>31.76(4.76)</td>
<td>+0.59(4.53)</td>
<td>0.70(28)</td>
<td>0.492</td>
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<tr>
<td>VRII Copy</td>
<td>32</td>
<td>79.72(23.06)</td>
<td>80.28(21.49)</td>
<td>+0.56(13.42)</td>
<td>−0.19</td>
<td>0.852</td>
</tr>
<tr>
<td>WMS-III Digit Span Total</td>
<td>34</td>
<td>11.62(3.95)</td>
<td>10.88(3.81)</td>
<td>−0.74(2.79)</td>
<td>−1.72</td>
<td>0.085¹</td>
</tr>
<tr>
<td>Token Test</td>
<td>32</td>
<td>143.75(15.89)</td>
<td>147.19(14.49)</td>
<td>+5.53(13.99)</td>
<td>−2.68</td>
<td>0.007**</td>
</tr>
<tr>
<td>BNT-2</td>
<td>34</td>
<td>33.59(13.36)</td>
<td>34.06(13.75)</td>
<td>+0.47(3.28)</td>
<td>0.84(33)</td>
<td>0.408</td>
</tr>
<tr>
<td>D-KEFS Verbal Fluency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Letter Fluency</td>
<td>28</td>
<td>21.75(13.34)</td>
<td>21.57(11.58)</td>
<td>−0.18(7.04)</td>
<td>−0.23</td>
<td>0.819</td>
</tr>
<tr>
<td>Category Fluency</td>
<td>30</td>
<td>15.97(8.94)</td>
<td>16.33(9.91)</td>
<td>+0.37(4.88)</td>
<td>0.41(29)</td>
<td>0.684</td>
</tr>
<tr>
<td>Category Switching Accuracy</td>
<td>28</td>
<td>3.14(2.73)</td>
<td>3.36(3.16)</td>
<td>+0.46(2.89)</td>
<td>0.44(27)</td>
<td>0.665</td>
</tr>
<tr>
<td>Trail Making A</td>
<td>30</td>
<td>104.80(67.45)</td>
<td>93.53(47.53)</td>
<td>−11.27(47.27)</td>
<td>−1.31</td>
<td>0.202</td>
</tr>
</tbody>
</table>

Note. Please refer to Table 1 for full titles of measures. For all measures except Trail Making A, a higher score represents a better performance.

¹p < 0.10; ²p < 0.05; ³p < 0.01.
There are a number of possible reasons for these discrepancies. This study might have picked up previously undetected changes, due to the complexity and sensitivity of the test used (as opposed to blunter tools, such as the MMSE and ADAS-Cog, used in previous research). Language has multiple components (Hodges, 2007) and it is therefore possible that the qualitative improvements in spoken language found by Spector et al. (2010) were due to a component other than naming or fluency, which were the only two aspects of language measured in the current study. Another possibility is that the smaller sample size in the current study lacked power to detect an effect in the domain of language expression. The failure to replicate an improvement on the MMSE could also be due to a lack of power to detect a relatively small effect.

In terms of the discrepancy in the memory findings, one possibility is that the word-list recall task, on which the Spector et al. (2010) conclusions were based, may be less sensitive to improvements than the story recall task used in the current study which, perhaps, has more ecological validity.

Neuropsychological mechanisms of change

One can cautiously speculate on the possible meaning of the findings in terms of understanding the neuropsychological mechanisms of change underpinning cognitive stimulation. One possibility is that the emphasis on verbal communication, central to the CST programme, could help to preserve syntax (i.e. the correct use of non-substantive components of language such as articles and prepositions according to strict grammatical rules; Hodges, 2007). This hypothesis would fit with the finding of an improvement on the Token Test which involves comprehension of increasingly syntactically complex commands. There is an increasing amount of literature supporting the “use it or lose it” principle which refers to the idea that activation of neurons may have a beneficial effect on neuronal function and survival during both normal aging and dementia (Swaab et al., 2002). The positive reinforcement of thinking, questioning, and expressing opinions throughout the CST programme could enhance the use of the neural pathways responsible for syntax and thus preserve this cognitive function.

Given the focus of CST on implicit learning and the absence of explicit rehearsal of material or training in encoding and retrieval strategies, the improvements found on both the verbal and non-verbal memory tests are somewhat unexpected. The verbal memory task involved listening to and recalling two short stories both immediately and after a delay. A parsimonious explanation for the improvement found on this task is that this could be mediated by an improvement in the ability to use and comprehend syntax since this would be likely to facilitate the comprehension and re-telling of stories. This does not, however, account for the enhancement in delayed visual recall.

An alternative explanation is that the intervention directly enhances learning and memory. The sessions create a positive but challenging learning environment which is designed to be optimal for people with dementia. It is possible that this environment could directly stimulate neuronal systems supporting memory in the brain, thus enhancing encoding and retrieval capacities (Swaab et al., 2002). The functioning of existing neuronal networks could thus be enhanced through stimulation but it is also possible that the challenges posed by CST promote the functioning of alternative neuronal pathways (Stern, 2002).

Time and place information is directly questioned at the beginning of each CST session. The findings of an improvement in orientation may reflect learning based on the explicit rehearsal of this information twice weekly.

Other mechanisms of change

There is evidence that negative age stereotypes can have a detrimental impact on the performance of older people on neuropsychological measures of memory (Hess et al., 2004). CST is a de-stigmatising intervention which values and encourages participants’ opinions and views. This could lead to a reduction in negative self-stereotyping, which could have a positive impact on test performance. The cognitive domains which appear to be most influenced by CST are language and memory. These domains are the main focus of CST and thus are likely to be the aspects of cognitive functioning for which stigma is most reduced.

Limitations

The findings need to be considered as preliminary and interpreted conservatively. The pretest–posttest design of the study meant that only complete data sets could be included in the analysis. The baseline differences in MMSE scores between those who completed the full battery of measures and those who failed to complete one or more items suggest that the findings are somewhat biased towards those with a higher level of overall cognitive functioning.

The lack of a control group means that it is not possible to entirely rule out the possibility that the improvements found were simply due to placebo or practice effects. However, it is unlikely that participants with dementia would have much, if any, explicit recall of the content of the tests after a
nine-week period and there is evidence demonstrating that practice effects do not occur in people with dementia, even in the mildest stages (Cooper et al., 2001). Furthermore, control participants in the original Spector et al. (2003) RCT declined over time on both the MMSE and ADAS-Cog, thus demonstrating an absence of practice effects on these measures.

A further drawback of not having a control group was that it was only possible to assess for improvements in cognitive function. A positive outcome could be maintenance of cognitive function (i.e. no change) given the expected trajectory of decline. The limitations created by the lack of a control group were, however, outweighed by the ethical difficulties in creating a waiting list control group for a treatment with proven efficacy. There was no control for the use of anti-dementia medication. Of those taking medication, the majority were on a stable dose of cholinesterase inhibitor (i.e. they had been taking their current dose for at least two months) at pre-group assessment and therefore any improvements in cognitive functioning due to medication should have already plateaued. However, information regarding length of medication use was not available for all participants and it is possible that changes to anti-dementia medication could have occurred during the study. Finally, the study was slightly under-powered, which means that the probability of making Type II errors was somewhat increased.

Implications

This study points towards benefits in memory, comprehension, and orientation for people with mild to moderate dementia who participate in CST. The clinical significance of these findings in terms of functional benefits is unclear. Possibly, the lack of demonstrated effects on attention, executive function, and praxis may reduce the impact of cognition-focused interventions like CST on clinical outcomes. Additionally, small statistically significant gains on neuropsychological tests do not necessarily equate with improved performance of daily tasks, although a previous study did find that cognitive improvements mediated improvements in self-rated quality of life for people with dementia (Woods et al., 2006). If improvements in memory, comprehension, and orientation are perceived by people with dementia who take part in CST, this could have a positive impact on self-esteem which may, in turn, enhance mood and quality of life.

Future research

Future research is needed to further investigate the neuropsychological outcomes and mechanisms of change of CST. The current study could be repeated and refined by using a larger sample to increase power and revising the test battery in order to minimise floor effects. The battery could also be designed to further explore specific hypotheses regarding the mechanisms of change. For example, the language processes that may mediate a perceived improvement in spoken language could be further explored by using a detailed language assessment battery such as the Boston Diagnostic Aphasia Examination (BDAE-3; Goodglass et al., 2001). Memory processes could be examined by using a measure such as the California Verbal Learning Test (CVLT-II; Delis et al., 2000), and executive functioning using the Delis–Kaplan Executive Function System (D-KEFS; Delis et al., 2001).

Another potentially useful avenue for future research would be a dismantling study to identify the “active ingredients” of CST. These findings could be used to inform the care of people with dementia more generally in terms of the key aspects of CST being incorporated in day-to-day care and interactions. Finally, it would be interesting to use functional brain imaging to see if any of the neuropsychological changes promoted by CST correlate with changes in the activity of the brain at a neurobiological level.

Conflict of interest

There was no source of financial support for this work. Aimee Spector and Joshua Stott offer CST training courses on a commercial basis.

Description of authors’ roles

Louise Hall conducted this research for her DClinPsy thesis. She collected and analysed the data, and wrote the first draft of the paper. Aimee Spector was the primary supervisor for this research. She has commented and edited several drafts of the paper. Martin Orrell was the secondary supervisor for this research. He has commented on several drafts of the paper. Joshua Stott consulted on the neuropsychological aspects of the research. He has commented on drafts of the paper.

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**References**


