**INTRODUCTION**

- Patients with dementia exhibit an impaired serial position effect (SPE) on word list learning tasks, recalling fewer items from the beginning of the list (primacy position) than the end of the list (recency position), i.e. a "recency effect".1,2
- The recency effect in learning is hypothesized to reflect dementia patients’ diminished capacity to encode primacy items at a semantic level and consolidate this information, and relatively intact rehearsal processes which facilitate recall of recency items.3,4
- However, neuroanatomical confirmation of this hypothesis is lacking and it remains to be established whether recency effects are apparent on delayed recall.3

**AIMs**

**Aim 1:** To determine the fate of primacy and recency items at short and long delay in healthy individuals and those with dementia.

**Aim 2:** To determine the functional neuroanatomy of serial position effects in dementia at learning and short and long delay using voxel-based morphometry (VBM).

- We hypothesized that poor primacy recall correlates with diminished integrity of the verbal semantic system, while poor recency recall correlates with phonological processing in the superior temporal gyrus (STG).

**METHODS**

**Table 1.** Demographic characteristics and Mini-Mental State Examination (MMSE) scores (mean±SD).

<table>
<thead>
<tr>
<th>PARTICIPANTS</th>
<th>HEALTHY CONTROLS (N=62)</th>
<th>DEMENTIA (N=69)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>66% male</td>
<td>53% male</td>
</tr>
<tr>
<td>Age (yrs ± SD)</td>
<td>70.2 ±8.3</td>
<td>62.2 ±9.4</td>
</tr>
<tr>
<td>Education (yrs ± SD)</td>
<td>13.2 ±2.61</td>
<td>13.5 ±3.3</td>
</tr>
<tr>
<td>MMSE</td>
<td>29.16 ±0.89</td>
<td>27.96 ±2.09</td>
</tr>
</tbody>
</table>

**MEASURES**

Behavior: The California Verbal Learning Test (CVLT) using 16 items was measured at 3 time points: cumulative across 5 learning trials (TR1-5), Short Delay (SD), and Long Delay (LD). Free recall was measured as % accuracy1 at primacy and recency list positions. MRH: High-resolution (1mm³) T1-weighted, 3-D MPRAGE images acquired were within 2 months of behavioral testing.

**ANALYSES:**

Behavior: A Group(2: HC, DEM) x Time (3: TR1-5, SD, LD) x Position (3: primacy, middle, recency) mixed model repeated measure ANCOVA with %correct as DV, Tukey post-hoc, and age as covariate was conducted.

VBM: Gray matter (GM) volumes aligned to a study-specific template and normalized to MNI space using the DARTEL approach, and smoothed with a 8mm FWHM Gaussian kernel in SPM8. Multiple regression analyses tested which brain regions were significantly associated with each list position score while controlling for the influence of total GM, age, and the remaining 2 positions. Statistical parametric maps from were thresholded at p=.01, and peak clusters surviving p-value of < .05 adjusted for the entire brain are reported in MNI space.

**RESULTS**

**Behavior**

- Trials 1-5
- Short Delay
- Long Delay

**Correlations with primacy measures**

- No significant recency correlations

**Correlations with recency measures**

- No significant recency correlations

**CONCLUSIONS**

- Strikingly, dementia patients’ recency effect at learning was lost at short and long delay;
- Poor performance with recency items compared to primacy items at delay indicates a specific inability to consolidate recency items, and suggests that this relative behavioral measure may serve as an important indicator of dementia.

**VBM**

- Primary item learning was uniquely associated with verbal semantic processing sites, while recency item learning was associated with bilateral aMTL and STG integrity, demonstrating a functional-neuroanatomic dissociation in SPE learning.
- At delay, only primacy item recall uniquely correlated with aMTL, indicating a consolidation of initially deeply encoded primacy items, and suggesting that delayed primary measures are most sensitive to aMTL pathology.