Gaze Allocation of Older People with Dementia Walking in Controlled Pedestrian Environment

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Age-related visual impairments: prevalent in the ageing population

Normal vision  Cataracts  Macular Degeneration  Glaucoma

Source: http://www.caregivercollege.org/scoa/?VisionLoss.html
Posterior Cortical Atrophy (PCA)

**Figure 2.** Regional variation of cortical thickness in PCA compared with controls for the left and right hemisphere. The color scale represents FDR-corrected $P$ values at a 0.05 significance level. Red and yellow (positive values) represent lower cortical thickness in PCA compared with controls, whereas dark and light blue (negative values) represent greater cortical thickness. A—anterior, P—posterior.
Possible visual problems in dementia/PCA

• Difficulty recognizing familiar objects and faces
• Difficulty reading, writing, emailing, dressing
• Difficulty judging distance/speed/perspective
• Increased sensitivity to bright lights/shiny surfaces
• Double vision
• Stationary objects may appear to move
• ……
Negative consequences

- Bumping into things
- Difficulty reaching for things within visual field
- Getting lost or disorientated
- Difficulty locating people or objects
- Misinterpreting reflections or images
- Difficulty in positioning oneself accurately
- ……
Not curable but **treatable**: interventions

- CIE196:2011 Guide to Increasing Accessibility in Light and Lighting
- TC 1-54: Age-related Change of Visual Response
- TC 3-44: Lighting for Older People and People with Visual Impairment in Buildings
- Royal National Institute of Blind People (RNIB)
  - Report: Improve the lighting in your home
- **What type(s) of environmental adaptation is(are) effective for dementia-related visual impairment?**
Dementia Vision

Seeing what they see: Compensating for cortical visual dysfunction in Alzheimer's disease

Seeing what they see is a four-year Economic Social and Research Council (ESRC) and National Institute for Health Research (NIHR) funded programme led by Sebastian Crutch at UCL.

The programme aims to:
1. better understand the functional impact of dementia-related visual impairment;
2. develop home-based interventions which address dementia-related visual impairment in order to improve independence and quality of life of individuals with dementia and their caregivers.

Please contact Keir Yong for more information about the study.
Validating candidate visual aids in PAMELA
Previous study on world’s first gene therapy for inherited blindness.

Method

- Two lighting levels: averagely 150 lux vs 15 lux
- 3 Routes: straight, U-turning, Dogleg
- Forward & Backward
- With/without dynamic LED stripe
- Participants (mean age > 60): 10 PCA + 9 tAD + 13 controls
Method

• Previous studies show that gaze allocation tend to be more ‘downward’ when walking task is more difficult
  – among older pedestrian
  – obstacles
Results – General Gaze Allocation

- Two dementia groups look more on floor – suggesting higher visual demand to perform walking task
Results – Gaze on floor

- General no effect of lighting or visual cue

![Bar chart showing median values for different conditions: Control, PCA, and tAD with Low_no_cue, Low_cue, High_no_cue, High_cue.](chart.png)
Results – Gaze on edge

- Spatial Frequency vs Optical Flow
Results – Fixation frequency and duration

- PCA group make more frequent and longer fixations ($p<0.001$)
Current findings from eye-tracking

- Walking is more visually demanding for people with dementia
  - PCA: 57% on floor; 2.91±0.84 fixation/s; 174±36ms
  - Controls: 20% on floor; 2.29±1.09 fixation/s; 141±44ms

- People with dementia tend to have
  - More fixation allocated on floor
  - More frequent fixation
  - Longer fixation duration
What’s next?

• Further evidence from gait measures
• Other candidate visual aids emerged from parallel qualitative studies
Many thanks!