Experiment Protocol

**Purpose**

We tested the hypothesis that older adults are less efficient in inhibiting the processing of irrelevant or unwanted information using eye-tracking during a route learning task. If the findings translate to the context of route learning, or more precisely, landmark selection, it would suggest that older participants would be less efficient in attending to and selecting navigationally relevant landmarks if these are presented alongside more salient but task-irrelevant objects.

**Participants**

A total of 80 participants (32 younger adults [17 females; mean age 24.25 +- 6.38 years; range, 18-40] and 48 older adults [24 females; mean age 73.28 +- 4.82 years; range, 66-82]) took part in the experiment. Ethical approval was obtained from the Science, Technology & Health Research Ethics Panel at Bournemouth University and written informed consent was obtained from all participants, in accordance with the declaration of Helsinki (World Medical Association, 2000). Most of the younger participants were Psychology undergraduates at Bournemouth University and were rewarded course credits for their participation. The older participants were volunteers who were receiving reimbursement for their participation in the study.

**Neurocognitove tests**

Before the route learning experiment, participants were administered a battery of cognitive tests to assess overall cognitive function, verbal and visual memory, and working memory (see ParticipantList\_Neurocognitive\_Scores.csv). This assessment included: Rey-Osterrieth Complex Figure Test (ROCF; copy, immediate recall, delayed recall), Digit Span (forward & backward, WAIS IV), Word List I & II (WMS III), Spatial Span (aka “Corsi Block”, forward & backward, WMS III), and the Mini-Addenbrooke's Cognitive Examination (M-ACE). Additional questionnaires were administered to collect demographic data and to determine the participant’s depression level (HADS) and their sense of direction (SBSOD).

**Apparatus**

Eye movements were captured using a head-mounted eye tracker (EyeLink II, SR Research Ltd., Ottawa, Canada) sampling left eye pupil position at 500 Hz. Calibration was performed and checked for accuracy before starting the experiment using a nine-point grid. Drift correction was performed before each stimulus presentation (video or static image). The experiment was presented on a 40″ CRT monitor with a resolution of 1920x1080 and a refresh rate of 100 Hz. Participants were seated 100 cm in front of the monitor. Experiment Builder (SR Research Ltd., Ottawa, Canada) was used for displaying the visual stimuli and the recording of eye-movements, as well as responses given via a standard computer keyboard.

**Procedure**

For each of the twelve routes the same procedure was used: in the training phase, participants were shown the video of the route through the virtual environment. In the subsequent test phase, full-screen images of the four intersections were presented in a random order and participants had to indicate the movement direction required to continue along the route by pressing the corresponding arrow key using a standard keyboard. The images were displayed until the response was made. There was no time limit for the responses, but participants were instructed to respond quickly and accurately. By randomising the order in which intersections were presented in the test phase, we ensured that participants could not simply remember the order of turns along the route, but instead had to rely on the object information to solve the task. Training and test phase were repeated until a route was successfully learned, i.e. until all test phase responses were correct, or until the route was presented for a total of five times. The 12 routes were presented in a random order. For calibration purposes, a fixation dot was shown before each of the images and the videos.

**Analysis**

*Behavioural data:* for each route we recorded the number of repetitions (i.e. training trials) participants needed to learn the route. For each stimulus presented in the test phase, participants’ responses (left, right, or up) as well as their response time were recorded. Data of all participants (46 older and 32 younger) entered the analyses.

*Eye movement data:* eye movements were recorded for both the training and the test phase and interest areas were defined around both objects (“left”, “right”) as follows: for the training phase a time window of 5 seconds before crossing the intersection (=2500 frames) was chosen where both objects were fully visible. The interest areas that were created for the analysis grew dynamically while approaching the intersection, i.e. the area’s size increased every 500 ms (=250 frames) These looming interest areas ensured that fixations could be assigned to the objects more precisely than using fixed sized interest areas. For the test phase, fixed interest areas of the same size each were defined around the objects. For both training and test phase, the area outside of the object interest areas was labelled as “non-objects”. Due to technical issues with the eye-tracker, data from 4 older and 1 younger participant was removed from the eye movement analysis.

Fixations shorter than 80 milliseconds were removed from the data set. Fixations were detected using SR Research’s velocity and acceleration based algorithm with a fixed velocity threshold of 30°/s and an acceleration threshold of 8000°/s (Eyelink User Manual, 2005).