# Method

## Participants

Ten participants were recruited using Prolific, an online participant recruitment platform. For each session they completed, participants were paid at a rate of 6.50 GBP/hour. Nine of the ten participants completed a total of ten sessions, while the remaining participant completed nine sessions. Participants were provided with plain language statements and consent forms and gave informed consent prior to the start of the first session of the experiment.

## Stimuli and Apparatus

The experiment was run online and presented in the browsers of participants’ computers. Participants were instructed to keep the browser in fullscreen mode for the duration of each session, and to use the same display across sessions. Software written in JavaScript using the jsPsych library (de Leeuw, 2015) controlled stimulus presentation and recorded responses. De Leeuw and Motz (2016) compared the accuracy of RTs recorded using JavaScript and under laboratory conditions using Psychophysics Toolbox and found that the JavaScript introduced a small and consistent measurement bias: RTs recorded under Javascript were around 25 ms longer than under Psychophysics Toolbox, but there were no systematic differences in RT variability. Biases of this magnitude are negligible for the purposes of the inferences we wish to draw about RTs in our task. Stimuli were low-frequency, four-letter words from the SUBTLEXus database (Brysbaert & New, 2009). Word frequencies ranged from 1 and 300, which represents the number of times the word appears in the corpus of 51 million words. Words were displayed in 24 point Courier New white font positioned in the center of a uniform gray mean luminance field. The use of a monospaced font and the restriction to four letters ensured that stimuli always occupied the same amount of space relative to the size of the screen.

## Procedure

Participants completed the experimental tasks over three sessions. Each of the three sessions consisted of 120 trials, presented in 12 blocks of ten items each. Each block consisted of a study phase, a mathematics distractor phase, a recognition phase, and finally a source recall phase. There were a further five practice trials at the beginning of each session, the data from which was not included for analysis. Presentation format was manipulated between participants, with participants randomly allocated to either a simultaneous study condition or a sequential study condition, which remained the same across experimental sessions for each participant. All other phases were identical between the conditions.

In the sequential study condition, participants were presented with a black marker positioned on a randomly generated angle on the outline of a circle at the start of each trial for 600 ms. The presentation of the marker was followed by the display of a word in the center of the screen for 1500 ms. To ensure that participants attended to the source information, they were instructed to indicate the previous location of the cross on the blank target circle using a computer mouse. Responses made within π/8 radians of the true target location were classified as attended and advanced participants to the next item. Responses further away were deemed unattended and the words “TOO DISTANT” was displayed for 1000 ms, then the location was then re-presented and the verification task was repeated.

In the simultaneous study condition, participants were presented with the marker and the word simultaneously for 1000 ms. Instead of being positioned in the center of the screen, in the simultaneous encoding condition, the word was positioned at the same angle as the marker, offset by a longer radius. The location of the word relative to the marker was determined by the sector the angle was in, with the word being offset to one of eight points on the bounds of the text box, corresponding to the middle of each of the four sides, and the four corners (i.e. in the North sector, the anchor was the bottom middle of the text box, while in the Northeast sector the anchor was the bottom left of the text box). As with the sequential condition, a verification task followed each presentation, which was repeated until participants reproduced the location to within π/8 radians of the presented angle.

After studying each of the items for that block, participants were then instructed to complete a distractor task, which involved 30 seconds of arithmetic problems. These problems were presented as three single digit integers, which summed to a fourth number which would either be the correct sum, or a number that was one higher or lower than the actual sum. Participants indicated if the sum was correct by pressing the keys 0 (false) or 1 (true).

In the recognition phase, participants were shown a shuffled list of 10 previously studied items and 10 foils and asked to rate each item on a six-point Old/New confidence scale. Participants responded by pressing a number from 1 to 6 on their keyboard, with 1 representing “Sure New” and 6 representing “Sure Old”.

Finally, in the source memory retrieval task, participants were cued with the words for 1500 ms, and then indicated the recalled location by a moving the mouse from the starting point in the center of the circle to a point on the circumference of the response circle. Response time was measured from the first movement of the mouse beyond a calibration marker, which was a circle with a radius of 8 pixels in the center of the screen. The cursor was required to be centered on this calibration marker to begin each trial. There was no time limit on the decision task. A schematic for one trial in each of the phases is shown in Figure 3.