Spatial Intelligence and Memory for Location in Athletes and Non-Athletes

Laura A. Janosko, Giuseppe G. Miranda, Eric Gammarino, & Lauren Ellinghausen
Advisors: Susan T. Davis, Ph.D., Benjamin R. Kunz, Ph.D., & Adam J. Barnas, B.S.
University of Dayton

Background

Seven tasks have been used to assess memory for location and spatial abilities. The tasks measure average short term memory, accuracy in spatial location recall, the ability to mentally perform tasks, the ability to visualize different perspectives, navigational abilities, mental rotation of objects and handedness.

Lloyd & Bunch (2010) found that spatial learning and spatial working memory were positively correlated with experience. Similarly, Brockmole, Hambrick, Sindisch & Henderson (2008) found that expert chess players performed better than non-experts in determining the position of a search target. They suggest that there is a difference due to semantic meaning, when the experts relate the spatial task to a familiar context (chess). We anticipate that athletes and non-athletes in our experiment will form a context for the spatial task and results will be similar to those demonstrated in Brockmole et al. (2008).

The memory for location task will have several variables, including number of distractors and the presence of a landmark. Increasing the number of distractors in a location memory task slows recall for target information (Sternberg, 1966).

Hypotheses

Memory for Location Task

We expect to see a difference in spatial abilities and location recall, because of athletes’ years of experience with pattern recognition and spatial tracking (Abernathy, Baker & Cote, 2005).

Distractors will hinder the ability to recall the location of a target for both athletes and non-athletes.

Landmarks will facilitate memory for location in athletes by functioning as a spatial prototype for a region (Plumert & Hund, 2001).

Memory Span Task

Athletes and non-athlete participants will have similar scores on a short-term memory span task because this memory skill is not part of an athlete’s specialized memory skill set.

Method

Participants: 27 participants classified as athletes and 27 classified as non-athletes.

Tasks: Memory Span Task (RSVP) – A series of 6-12 phonetically distinguishable consonants are presented in a random order (e.g. X, Q, R, P, S, T). The series are separated by a mask, after which participants are to recall as many of the letters possible without regard to presentation order

Memory for Location (M4L) – A test of spatial memory in which participants are shown a series of slides in quick succession and prompted for the beginning or ending location of a blue stimulus among green distracters and, in some instances, a landmark.

Starting Location

Ending Location

Spatial Orientation: They are to imagine they are standing at one object and facing a second object. The task is to draw an arrow from the object where one is ‘standing’ to a third object.

Mental Rotation (MR): Participants decide which two out of four configurations are the same as the one shown on the left. This task is used to test the accuracy in perceiving the spatial layout of an object.

Handedness: This survey identifies which hand is dominant in common activities. Previous research has suggested that there is a correlation between handedness and spatial abilities.

Procedure:

Both athletes and non-athletes complete all 7 measures. These 7 tasks previously described are presented to participants in a counter-balanced and random order. M4L, RSVP, Handedness and SBSOD are completed on a desktop computer. The MIQ-R, SO, and MR tasks are administered on paper. The total time to complete all tasks is between 60 and 90 minutes.

Results

Athletes performed significantly better than non-athletes on the memory task for location task (Figure 1) when landmarks were not present (t (1, 56) = 9.82, p < .007, MSE = .021, eta2 = .412).

As expected, landmarks decreased the difference in accuracy between athletes and non-athletes (Figure 2). We also found regular working memory did not differ between the two groups, p > .05.

Discussion

Our hypotheses were supported. We found no difference in working memory between athletes and non-athletes, suggesting any difference in performance on other tasks was not due to a larger short term memory.

We found athletes performed better on the memory for location task when landmarks were not present (Figure 1). This result suggests athletes have augmented their spatial abilities through consistent practice.

Landmarks decreased the performance difference between athletes and non-athletes (Figure 2). Our results were similar to Plumert and Hund’s (2001) experiment, which demonstrated participants were made more accurate distance judgments when space was broken up with markers.