Athletic Superiority for Spatial Intelligence and Memory for Location?

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Background

- In addition to their superior physical skills, athletes also possess specific cognitive advantages to their non-athlete counterparts. Specifically, athletes have been shown to possess better memory for location and spatial intelligence.
- Other research has studied spatial expertise. Brockmole et al. (2008) found that expert chess players performed better than non-experts in determining the position of a search target. This difference is thought to be due to semantic meaning, that is, when experts relate the spatial task to a familiar context (chess).
- Similarly, Lloyd and Bunch (2010) found that spatial learning and spatial working memory were positively correlated with experience.
- In the present experiment, seven tasks were used to assess memory for location and spatial abilities. The tasks measured 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.
- The memory for location task had several variables, including number of distractors and the presence of a land mark. Increasing the number of distracters in a location memory task has been shown to slow recall for target information (Sternberg, 1966).

Hypotheses

Memory for Location Task

- We expected to see a difference in spatial abilities and memory for location because of athletes' years of experience with pattern recognition and spatial tracking (Abernathy, Baker & Cote, 2005).
- Distracters would hinder the ability to recall the location of a target for both athletes and non-athletes.
- Landmarks would 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.

References

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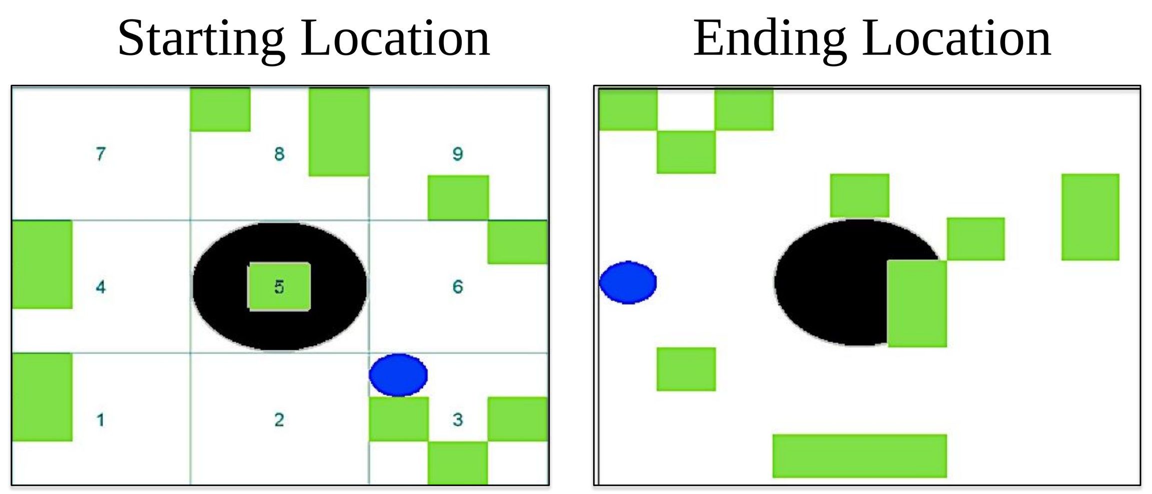
Method

Participants: Half of the participants were categorized as athletes while the other half were categorized as non-athletes. Athletes were defined as having 6 or more years of experience in a team sport played until at least at the high school varsity level. Non-athletes were considered those who did not meet this criteria.

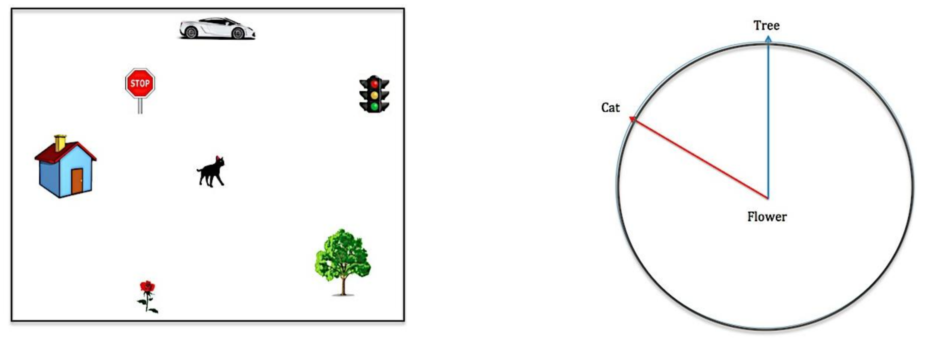
Tasks:

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

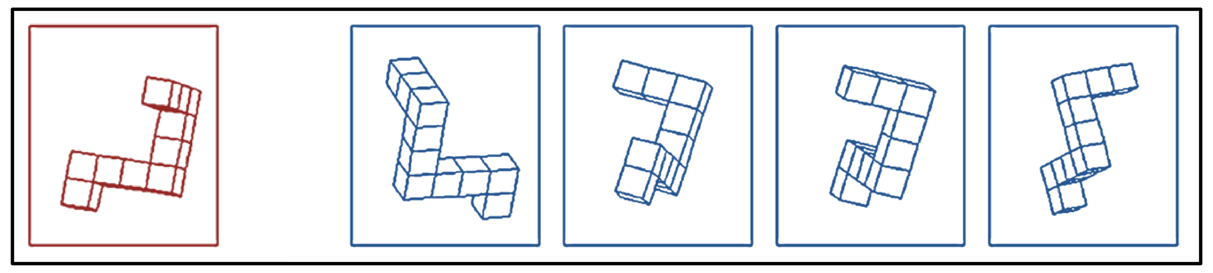


Memory Span Task (*RSVP*) – A series of 6-12 phonetically distinguishable consonants are presented in a random order (e.g. X, Q, R, P, S, T). The series are separated by a mask (white noise screen), after which participants are to recall as many of the letters possible without regard to presentation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

Spatial Orientation (SO) –Participants view an array of objects (below). 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 of the 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.



Santa Barbara Sense of Direction (SBSOD) – This survey assess directional and navigational abilities, providing information on how well participants navigate in their environments.

Movement Imagery Questionnaire- Revised (MIQ-R) – Participants perform a particular body movement, such as jumping, and then must either visualize the movement or attempt to feel themselves performing the movement. The MIQ-R assesses the ability to use kinesthetic and visual imagery.

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.

Results and Discussion

- The results of analysis revealed little effects of expertise in athletics as we defined it, except for a test of a 3-way interaction between memory location, landmark condition and expertise that yielded an effect at the $p = .087$ significance value, $F(1, 26) = 3.168$, $eta^2 = .109$.
- As shown in the table below, performance is relatively high and consistent for athletes and non-athletes, regardless of whether the task is to recall the beginning or ending location of the target. The difference that points in the direction of an interaction with location of recall and expertise is whether a landmark is present or absent.
- While there is no difference between athletes and non-athletes when a landmark is present (for either location for recall), there is a difference in recall performance when a landmark is absent. Specifically, a landmark's absence has more of a negative effect on performance for athletes than non-athletes when memory is for the beginning location, while, in contrast, a landmark's absence has more of a negative effect on performance for non-athletes when memory is for the ending location of the target.

	Memory for beginning location		Memory for ending location	
	LM Present	LM Absent	LM Present	LM Absent
Athletes (n=15)	.78 (.04)	.74 (.03)	.78 (.03)	.71 (.08)
Non-Athletes (n=13)	.78 (.04)	.78 (.03)	.79 (.03)	.68 (.03)

- These results are consistent with a significant interaction of memory location and landmark ($F = 5.934$, $p = .021$), overall and a significant main effect of landmark ($F = 4.250$, $p = .049$).
- Also consistent with these overall results are the findings that athletes and non-athletes perform equally well on all of the spatial intelligence tests.
- Our anticipation that we would have "too many" athletes is consistent with results. Overall performance on the M4L task is similar for both groups. Athletes ($M = 0.76$, $SD = 0.10$) vs. Non-athletes ($M = 0.77$, $SD = 0.11$).
- Although our original goal was to compare inter-collegiate athletes with individuals with little to no experience in athletics, most members of our participant pool did not clearly qualify as one category or the other. Therefore, we altered our participant classification to best reflect our participant pool.
- Because of the difficulty of identifying participants with little to no athletic experience in the population that is our data source, future research analyses will focus on exploring athletic expertise as a continuum, attempting to derive an athletic "score" that can be used to evaluate the correlations with memory ability and spatial intelligence tasks.
- A second focus may be on a more stringent definition of what constitutes athletic expertise in a college population, considering only participants in inter-collegiate team-on-field sports (e.g., basketball, football, soccer) as athletes, and those who have engaged in little to no sports activities as non-athletes.