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An especial skill in elite wheelchair basketball players

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ABSTRACT

We aimed to investigate whether an especial skill is present in elite wheelchair basketball players when taking twenty shots with a regular basketball from five different distances (11 ft, 13 ft, 17 ft, & 19 ft) from the basket including the free throw line (15 ft). Twelve elite male basketball players participated. The results showed that as distance increased shot accuracy decreased in line with force by variability predictions for the 11 ft, 13 ft, 17 ft, & 19 ft distances. However, shot performance at the free throw line where players are more familiar with practicing free throw shots did not follow this trend. A linear regression line was drawn to predict performance at the free throw line based on nearer (11 ft & 13 ft) and farer (17 ft & 19 ft) distances to the basket, this was then compared to actual performance. A significant difference between actual and predicted scores was found ($p < .05$) supporting the presence of an especial skill. Significant positive correlations were found for the 11 ft and 17 ft distance, age, years of playing, and accumulated practice hours with performance at the 15 ft line ($p < .05$). These correlations imply the operation of generalization in the especial skill. This observation received support from applying a model in which shot accuracy as a function of distance was approximated by two regression lines.

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1. Introduction

In the original especial skill experiment exploring set shot basketball performance Keetch, Schmidt, Lee, and Young (2005) demonstrated that performance accuracy decreased as distance increased from the basket (9 ft, 11 ft, 13 ft, 15 ft, 17 ft, 19 ft, and 21 ft). This finding is in line with force by variability predictions and numerous principles of motor control (e.g., Schmidt, Zelaznik, Hawkins, Frank, & Quinn, 1979). However an unexpected finding was that accuracy in performance at the 15 ft distance was similar to that at nearer distances to the basket, a finding that was not in line with force by variability predictions (see Keetch et al., 2005, Fig. 1). Keetch et al. termed this an especial skill, which is a highly specific skill embedded within a more general class of motor skills. The especial skill was attributed to player's accumulating massive amounts of specific practice at the 15 ft distance as this represents the foul line in basketball. While this is a reasonable explanation, and tends to favor specificity in motor learning it has brought some debate as to whether the underlying structure of memory representations that govern motor learning are general or specific, and whether there is a need for a motor learning theory that encompasses both generality and specificity (for a review see Breslin, Schmidt, & Lee, 2012).

Several explanations have been proposed to explain the especial skill effect. According to Schmidt's (1975) schema theory, the generalized motor program (GMP) contains visuo-motor sensory information for each class of actions, in this case the relative timing of the limbs and joints used to perform a basketball free throw shot. A recall schema selects the appropriate force parameters required if distance from the basket increases or decreases to meet the task goal. When applied to the especial skill Schmidt in his schema theory would suggest that the underlying memory representation for the especial skill has to be general enough to meet the demands of shooting accurately across various distances, however it does not explain why performance at one particular distance (15 ft) should lead to a better performance over other nearer and farer distances given the same class of action is being implemented by the GMP.

Another model that has been used to explain generalization is that of structural learning. It suggests that humans generalize action based on limited information. They learn the general form of rules that govern a task, then extract the invariants between the different input–output variables which leads to faster learning for tasks sharing a similar structure. Evidence obtained in a number of studies (Mulavara, Cohen, & Bloomberg, 2009; Welch, Bridgeman, Anand, & Browman, 1993) shows that participants not only demonstrated faster adaptation rates in transfer but when faced with a different variation of the task they showed facilitation of learning (adaptive generalization). This can be applied to the shooting technique used in basketball as the fundamental principles/mechanisms of transfer are the same but the distance and angle changes according to where the shot is taken from.

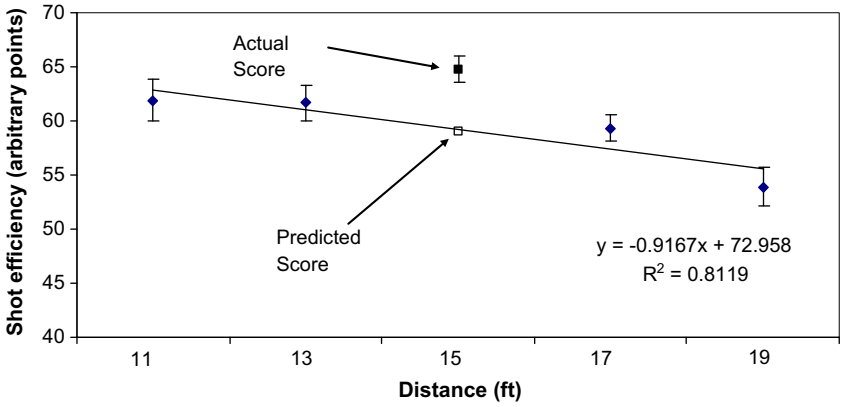

Fig. 1. Accuracy of set-shot performance (average correct shots and standard deviations) as a function of the distance from the basket. A regression analysis using the shortest three distances (11 ft, and 13 ft) and the longest three distances (17 ft, and 19 ft) yielded the line of best fit shown. Also shown are the predicted and actual values for performance at 15 ft.