SPATIAL ANALYSIS OF HIT DISTRIBUTION IN RECURVE ARCHERY

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Introduction

An end consists of 3 to 6 arrows, which are typically written on paper without information on the location of each arrow (Ertan et al., 2005). The arrows are only scored from highest to lowest leading to limited analysis possibilities. Distribution patterns of the hits on the target allow identification and analysis of spatial patterns (Callaway & Broomfield, 2012). Callaway and Broomfield (2012) validated an input method for these hits to analyse underlying continuous spatial distributions (Johnson, 2001). The purpose of the current study is to test whether marksmanship characteristics derived from hit distribution patterns can be used to differentiate archers at different performance levels.

Methods

Archers comprised of 3 groups (9 high-level, 13 middle-class and 7 beginner archers). Each archer shot 72 arrows at a 40cm target standing at 18 m. The hits on the target were photographed after each end and digitized using Matlab to create a coordinate system of arrow locations. Accuracy (variable & constant), precision, group locations, and straight-line distance (from the center) were calculated for each group and analysed using ANOVA and post-hoc LSD.

Results

Accuracy (AVE) showed elite were the closest to the center with 3.02cm, intermediate = 7.75cm and beginner =17.1cm. Group X locations showed elite and intermediate to the left of the target (-0.79cm & -4.18cm) and beginners to the right (1.57cm). Beginners showed a closer group to the center of the target than intermediate, but also the largest SD of 8cm. Group Y location showed that Intermediate and Beginner both shot 1.03 and 1.43cm high of the center with no significant difference between them. Elite shot -1.24cm low of center. Precision resulted in elite = 2.42, intermediate = 5.38 & beginner = 12.3cm size groups. Statistical differences were found between all factors, for all groups ($p < 0.001$) except between intermediate and beginner group Y location.

Discussion

As predicted, there were significant differences between elite, intermediate and beginner hit distribution. This demonstrates that the methods proposed previously (Callaway & Broomfield, 2012) can be useful for analysis in archery. Score alone ignores good groups in the wrong location on the target. Measures such as accuracy and precision offer a great benefit to future work. These measures here can be useful to archer, coach and analyst for performance improvements and equipment setup. If all archers had moved their sights in line with the results here, all could have scored higher overall.

References

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