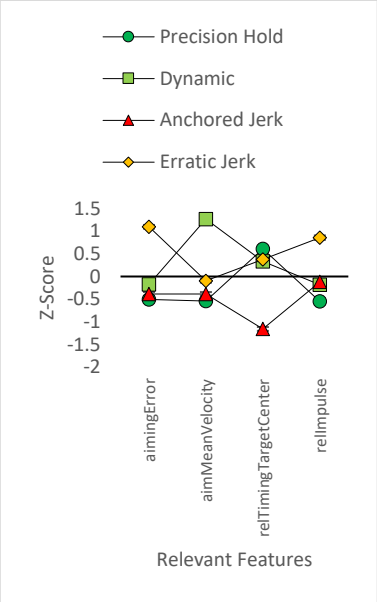
Effects of inter- and intraindividual compensation-sensitive shot styles on performance in Olympic air rifle shooting

Introduction: Aiming point analysis systems are commonly used in sports shooting but face four main challenges: they do not account for a) intra-session variations, they overlook b) inter-individual shooter preferences, they ignore c) compensation mechanisms of technical features, and they do not respect the d) real shot location at the target. The aim of the study was to investigate the effects of compensation-sensitive, shot styles on performance while accounting for all four challenges (a-d).

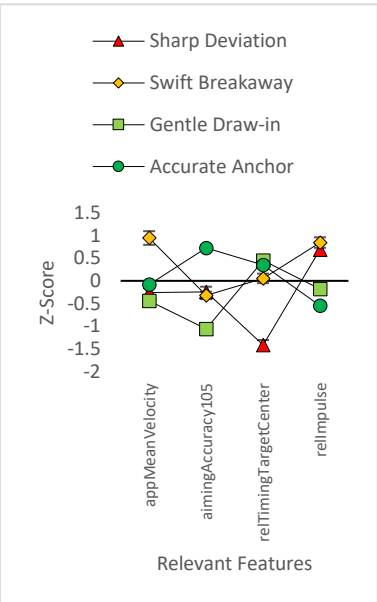
Methods: To address a) and b), we developed and validated an automated movement phase detection algorithm. Building on this algorithm and addressing challenge c) and d), this study applied cluster-analysis and ANOVA to determine the performance relevance of compensation-sensitive shot styles using datasets from a single athlete (SING) and 26 advanced to elite level athletes (HE).

Results: When compared to three independent expert ratings, the analysis demonstrated a high mean correlation between expert rating and movement phase detection algorithm ($r(717)=.81$, $p<.05$). In addition, significant performance differences in shot styles for both datasets, with each shot style distinctively differing from the others were found.



SING

	Precision hold	Dynamic	Anchored jerk	Erratic jerk
N shots	1288	1070	1398	1253
Description	low aiming error, low mean velocity during hold and aiming phase, low displacement of aiming point towards target centre during release phase	high velocity of aiming point during hold and aiming phase	low aiming error, low aiming point velocity during hold and aiming phase, aiming point motion away from target centre	high aiming error, aiming point motion with high displacement during release phase towards target centre
Performance [radial error in mm]	M = 1.040 SD = .588	M = 1.199 SD = .701	M = 1.464 SD = .640	M = 1.329 SD = .735



HE

	Sharp deviation	Swift breakaway	Gentle draw-in	Accurate anchor
N shots	233	235	264	568
N athletes	26	24	26	26
Description	high aiming point displacement during release phase away from target centre	fast approach velocity, high aiming point displacement during release phase	low approach velocity, low aiming accuracy, motion of aiming point towards target centre	high aiming accuracy, low aiming point displacement during release phase
Performance [radial error in mm]	M = 1.909 SD = .826	M = 1.652 SD = .846	M = 1.374 SD = .687	M = 1.040 SD = .524

Conclusions: Shot styles which allow for compensation and intra-individual movement phase differences exhibit performance variations. Coaches and athletes should emphasize holistic training, focusing on combinations of features that allow for compensation.

Ref: Tartaruga, D., & Kredel, R. (2024). Effects of inter- and intraindividual compensation-sensitive shot styles on performance in Olympic air rifle shooting. Current Issues in Sport Science, 9(1), Article 006. https://doi.org/10.36950/2024.9ciss006