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Gaze Strategies in Skateboard Trick Jumps: Spatio-Temporal Constraints in Complex Locomotion

Authors: Klostermann A[1], Küng P[1]
[1]Insitute of Sport Science, University of Bern, Switzerland

Introduction:
In the context of sports, only a few studies were conducted in which the functional role of visual information processing during locomotor behavior were investigated. In this regard, Vickers (2006) observed a look-ahead strategy in expert ice-skaters who regularly anchor their gaze at the inside line and the tangent point of the ice oval. However, the particular requirement that has been previously sketched with respect to walking (e.g. Patla & Vickers, 1997) and that also is characteristic for sports has not been investigated so far, namely the spatial-temporal adaptation of the locomotor behavior to overcoming obstacles. Therefore, this study aimed to further the knowledge on gaze behavior in locomotion by studying gaze strategies in skateboard jumps of different difficulty that had to be performed either with or without an obstacle.

Methods:
Nine experienced skateboarders performed “Ollie” and “Kickflip” jumps over either an obstacle or over plane surface. The skateboarders’ gaze behavior over two movement phases (“approach” and “jump”) were recorded with a mobile binocular eye-tracking system that was attached to custom-build swim goggles to minimize camera shifts. As dependent variables, the stable gaze at five different areas of interest was calculated regarding its relative duration as well as its temporal order. Separately for the approach and jump phase, the relative gaze duration was subjected to repeated measures ANOVAs as well as planned t-tests.

Results:
Over the approach phase, an interaction between area of interest and obstacle condition was found with longer stable-gaze locations at the take-off area in attempts with an obstacle. In contrast, in attempts over plane surface longer stable gaze locations at the skateboard were revealed. Regarding the trick-difficulty factor, the skateboarders showed longer stable gaze locations at the skateboard for the “Kickflip” than for the “Ollie” in the no-obstacle condition only. Finally, over the jump phase, neither obstacle condition nor trick difficulty affected gaze behavior differentially.

Discussion:
These findings imply that the skateboarders apply two different strategies when preparing the jump movement. In the case of an obstacle, the exact timing of the take-off needs to be planned to avoid a collision such that it is crucial to continuously update information about the distance to this point. In contrast, in the case of a plane surface, the skateboarders were only instructed to perform the jump within a certain jump zone such that motor planning could be predominantly directed to the mere execution of the jump which is reflected in the preferred stable-gaze location at the feet on the skateboard. In addition, the results corroborates earlier findings on the relation between task demands and foveal information processing hypothesizing that longer intervals for visual information processing are required as a function of fine-tuning demands over movement planning and execution (e.g. Klostermann, Kredel, & Hossner, 2013). In sum, this study underlines the functional adaptability of the visuo-motor system to changing demands in highly dynamic situations.

References:
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