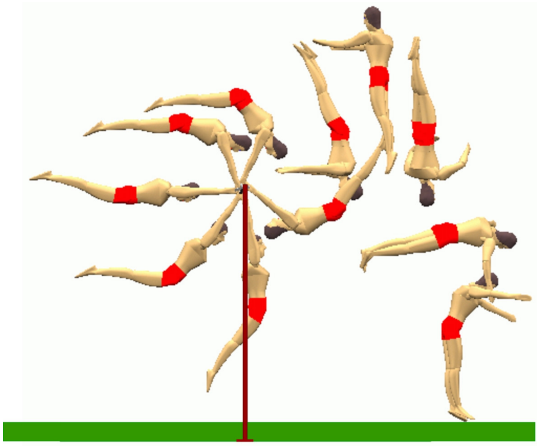
Hiley, M.J. and Yeadon, M.R. 2003. The margin for error when releasing the high bar for dismounts. Journal of Biomechanics 36, 313-319.

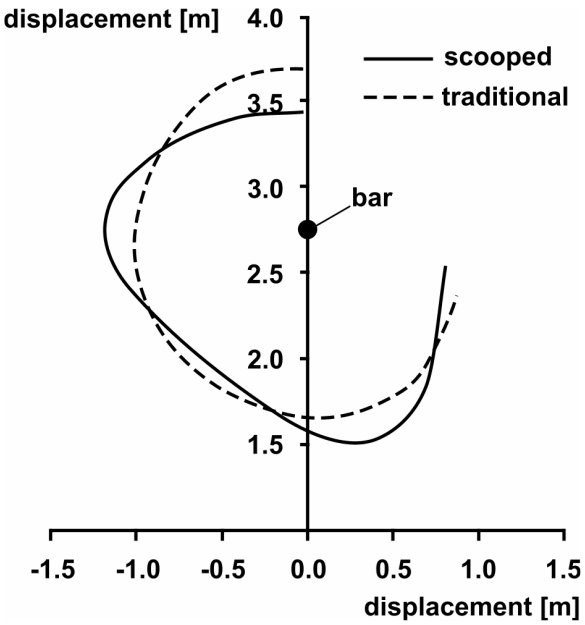
In Men's Artistic Gymnastics the current trend in elite high bar dismounts is to perform two somersaults in an extended body shape with a number of twists. Two techniques have been identified in the backward giant circles leading up to release for these dismounts (Hiley and Yeadon, 2003). At the Sydney 2000 Olympic Games 95% of gymnasts used the "scooped" backward giant circle technique rather than the "traditional" technique. It was speculated that the advantage gained from the scooped technique was an increased margin for error when releasing the high bar. The margin for error may be quantified in terms of the release window during which the gymnast has suitable linear and angular momentum for performing the dismount. If the gymnast releases at any time during this window he will have sufficient flight and rotation to complete the dismount.



A four segment planar simulation model of the gymnast and high bar was used to determine the margin for error when releasing the bar in performances at the Sydney 2000 Olympic Games (Hiley and Yeadon, 2003). The eight high bar finalists and the three gymnasts who used the traditional backward giant circle technique were chosen for analysis. Model parameters, including bar stiffness and damping coefficients, initial conditions and inertia parameters, were optimised to obtain a close match between simulated and actual performances in terms of rotation angle (average rms difference 1.2°), bar displacements (average rms difference 0.014 m) and release velocities (absolute difference 2%). Each matching simulation was continued beyond the point of release to determine the time window around the actual point of release for which the model had appropriate release parameters to complete the dismount successfully.

The scooped backward giant circle technique resulted in a greater margin for error (release window 88 - 157 ms) when releasing the bar compared to the traditional technique (release window 73 - 84 ms). The reason why the scooped accelerated backward giant circle produced a larger release window may be understood by looking at the path of the mass centre during the final ¾ giant circle. The mass centre path for a traditional technique (dashed line) and a scooped technique (solid line) are shown below. In the traditional technique the path of the mass centre is almost circular. Therefore, considering the concept of tangential release (the

direction of the release velocity makes an angle of 90° with the line joining the mass centre to the point of rotation), the release angle and velocity will be constantly changing as the gymnast approaches release. In the scooped technique, however, there is a flattening of the path of the mass centre leading up to release This flattening gives a gymnast similar flight conditions over an extended release period, when compared with the traditional technique.



By having a larger release window a gymnast using a scooped technique is likely to find it easier to time the release than a gymnast using a traditional technique since the timing is less critical.

Related Papers

Hiley, M.J. and Yeadon, M.R. 2003. Optimum technique for generating angular momentum in accelerated backward giant circles prior to a dismount. Journal of Applied Biomechanics 19, 119-130.

Hiley, M.J. and Yeadon, M.R. 2005. The margin for error when releasing the asymmetric bars for dismounts. Journal of Applied Biomechanics 21, 223-235.