

Laser based line-out simulator

Peter Brook, Hayden Croft¹, Dr Samuel Mann

Department of Information Technology
Otago Polytechnic

¹ Physical Education, University of Otago
smann@tekotago.ac.nz

The lineout simulator is an array of lasers designed to detect the trajectory of a thrown rugby ball. The device is a critical component of a wider study into the kinematics of the lineout throw.

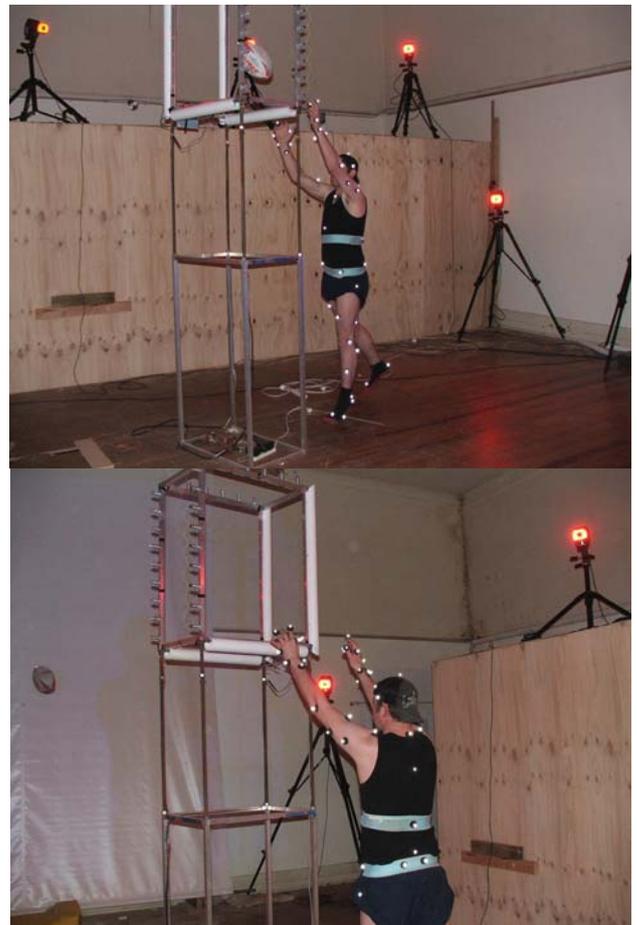
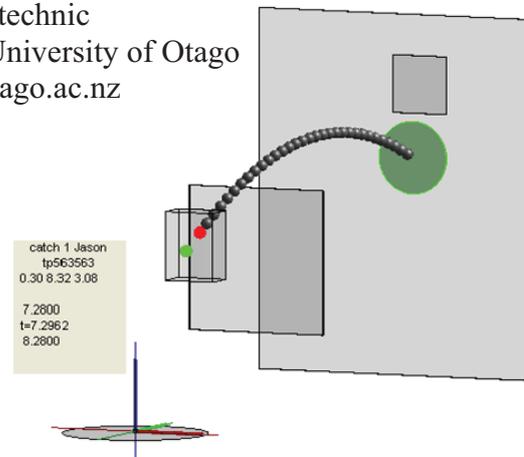
The lineout throw is a crucial component in determining whether a team wins possession of the ball. The accuracy and timing of the throw are both important factors in determining whether the opposition can intercept the ball, and these components are determined by the thrower's technique and ability to identify the target.

One of the downfalls of our country's rugby players in recent times has been their inability to master the skill of the lineout throw. Close analysis of the biomechanical factors determining success of the lineout throw will provide important insight into the way in which different players achieve a successful outcome with the throwing motion. Once identified a number of critical features will be explained so that they can then be passed onto coaches and players.

The research involved the calibration of a customized system for optimum motion tracking accuracy. A stereodigitizing photogrammetric technique was used to determine the accuracy of the system. The 12 cameras of the motion analysis system were positioned around the player to capture their movements from the point when they got into position awaiting the movements of the jumpers and lifters.

The presentation of lineout lifting and jumping players was standardised using a lineout simulator. The subject players were required to throw a ball towards a 3D video projection. As the player threw the ball towards the A pre-recorded series of lineout an array of laser sensors and computer software detected and determined the speed and trajectory of the ball. The calculated "virtual" landing position of the ball in the lineout was then compared with the pre-determined "real" position of the lineout jumper's hands to give a measure of throw-in accuracy.

As the ball passes through the specially constructed aluminium fabricated case it intersects two planes of 24 lasers. If unimpeded the lasers shine on a photo transistor so a signal gets passed to a microprocessor logging the time of occultation down to a millionth of a second. Out of an array of such intercept times, a parabola's equation is calculated and fed into Matlab for graphical depiction and analysis.



Chong, A.K. and Croft, H.G. (2005), *A Practical Spatial Data Capture Technique for Human Motion Research*. 17th Annual Colloquium of SIRC 2005, University of Otago, New Zealand, November 24th - 25th 2005.