The use of Quintic video analysis and biomechanics in British Diving

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When working in elite sport, there is a very small margin for error. In diving, the difference between being on the podium or not at major championships could be less than a single point. With diving being a subjectively scored sport, judges examine four parts of each dive: the starting position, the take-off, the flight, and the entry into the water. These are then scored across a range of 0 – 10, Completely failed: 0, Unsatisfactory: 0.5 – 2.0, Deficient: 2.5 – 4.5, Satisfactory: 5.0 – 6.5, Good: 7.0 – 8.0, Very Good: 8.5 – 9.5 and Excellent: 10

Therefore, in diving, a small change in take-off could result in multiple marks being deducted throughout the flight and/or entry of the dive or injury. Although large amounts of video are accessible, few biomechanical data collections have been conducted using the world's best at major competitions (Kong, Sim and Chiam, 2022). Therefore, British Diving wanted to begin to understand the requirement of completing such analysis at the World and British Championships.

Through conversations with coaches and other practitioners, prerequisites were identified for the analysis tool. When researching different biomechanical software to use to further the use of applied biomechanics in diving, Quintic was recommended by other biomechanics and analysis practitioners working in elite sports. Quintic enabled British Diving to calibrate a volume, complete two dimensional digitisation as well as calculate, overlay and export both linear and angular metrics.

Figure 1: An example utilising the video overlay function within Quintic using video from Fukuoka World Championships.

This was ideal, however, it was noted that the origin of the calibrated space was identified at the bottom left of the video being analysed. For many practitioners this would not affect the metrics exported, but for diving it was a large issue as most metrics were required to be calculated from the end of the platform or springboard.

Figure 2: An example of a digitised springboard diver from Fukuoka World Championships (Digitised points included: head, shoulder, elbow, wrist, fingertip, hip, knee, ankle and toe).

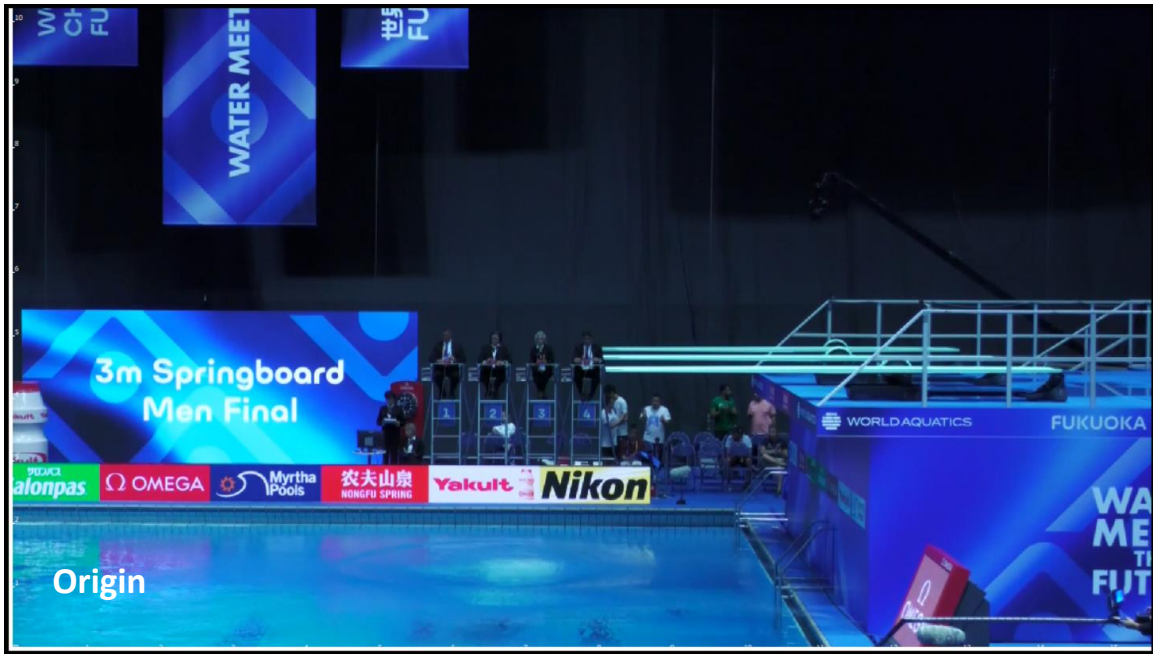

Figure 3: Bottom left corner identified as the origin before changes were implemented.

Quintic worked with British Diving, understood our requirements and provided us with the ability to change the origin to a specific location within the video.

Figure 4: Manual identification of origin after the changes were implemented.

The ability to change the origin enabled metrics such as vertical and horizontal displacement of the diver to be collected in relation to the platform and springboard. Specifically, these metrics can be monitored for injury mitigation, by highlighting the distance the divers head is away from the platform or springboard and for performance development. In relation to performance development the take-off holds high importance to the success of the dive with the ability to produce the appropriate forces and direction of centre of mass needed to achieve the required dive height, to complete the number of rotations throughout flight with sufficient time to enter cleanly.

In addition to the above metrics, peak hip height and velocity, horizontal distance from the board, trunk lean to the vertical at foot contact and take off, vertical head position at the point of pike initiation, hip angle at take-off, overall trajectory of the hip were all calculated for platform divers. Specifically for springboard disciplines time spent on the board and lowest point of deflection of the board were also calculated as important metrics to influence land training, in addition to diving technique. These could then be compared between athletes to identify key areas of difference and consequent improvement.

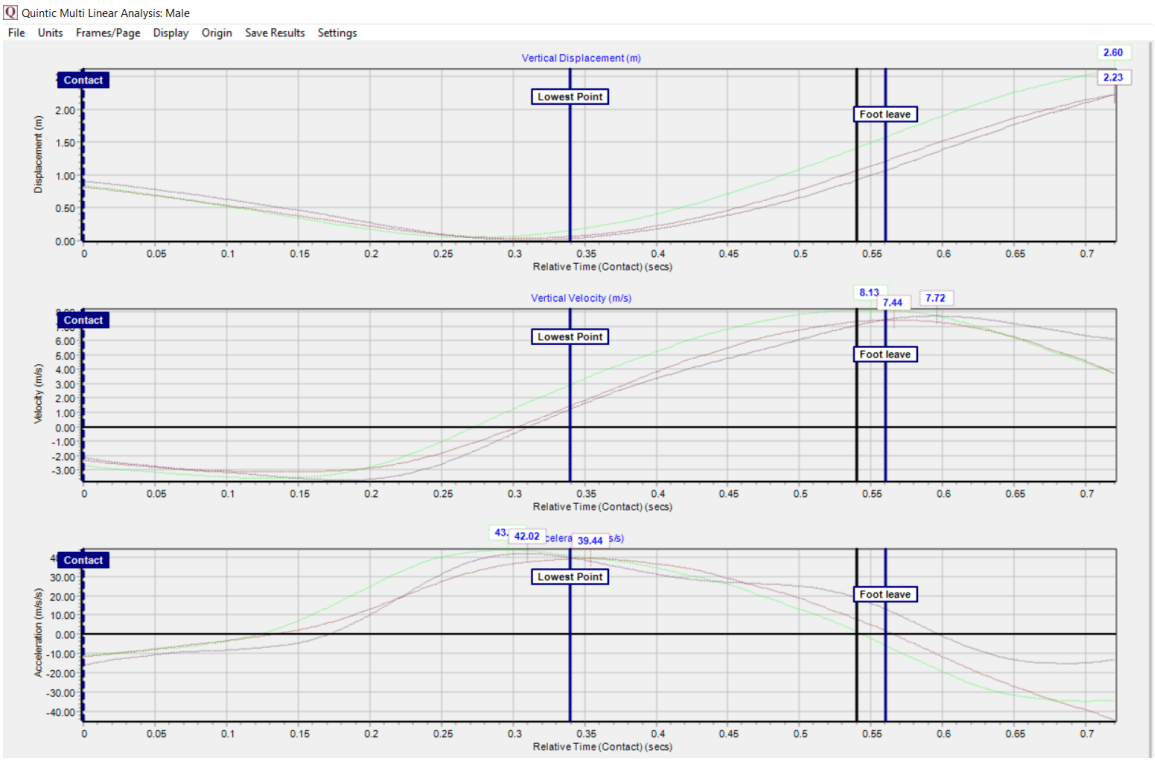

Figure 5: An example of three individual divers' hip displacement (m), velocity (m/s) and acceleration (m/s/s).

In addition, through the calculation of these metrics a mean and 95% confidence interval could be calculated for a small cohort of the world's best divers, thus identifying a targeted range for each metric.

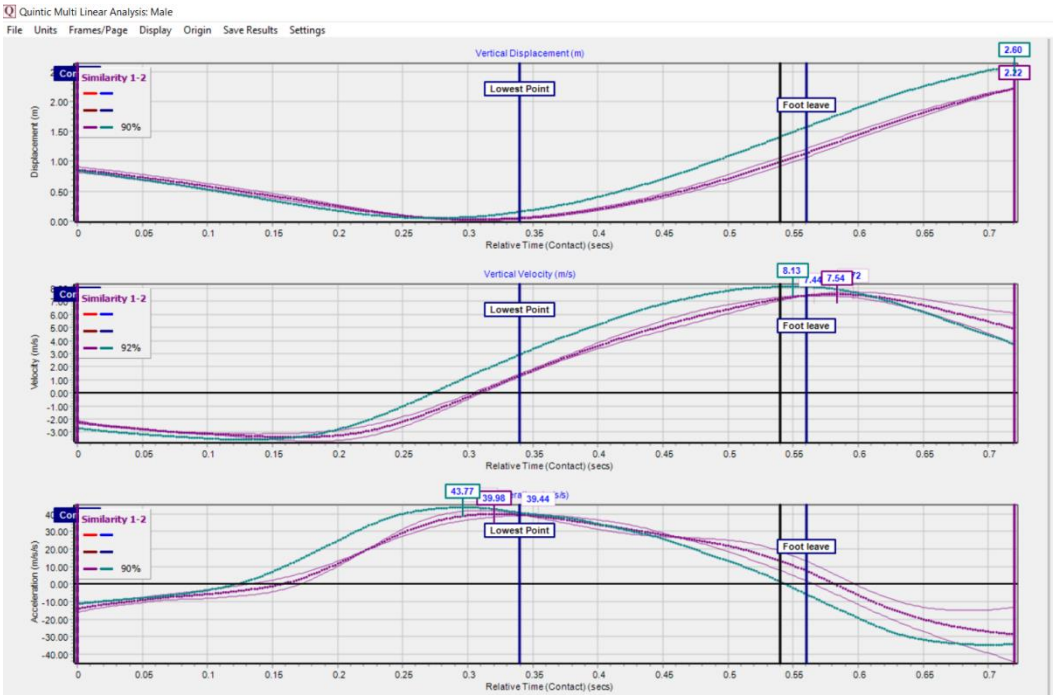

Figure 6: An example of hip displacement (m), velocity (m/s) and acceleration (m/s/s) for the average of two international divers compared to one British diver.

This information was used by coaches to highlight areas of improvement, to inform coaching decisions and interventions, and used thereafter as a monitoring tool to identify if changes had successfully been made. The implemented change of origin has improved the usability of analysis by enabling specificity of data to the diving environment, allowing coaches to utilise the information to guide their coaching.

References

Kong, P.W., Sim, A. and Chiam, M.J. (2022) 'Performing meaningful movement analysis from publicly available videos using free software – a case of acrobatic sports', Frontiers in Education, 7. doi:10.3389/feduc.2022.885853.