Reliability and Validity of a lap time collection method using public videos

Submission Type

Technical Report

Authors

Graham J. Mytton1,3, David T. Archer2, Alan St Clair Gibson3,Kevin G. Thompson­4

1. Department for Sport and Enrichment, Sunderland College, Sunderland, UK.
2. Department of Sport and Exercise Sciences, University of Sunderland, Sunderland, UK.
3. Department of Sport and Exercise Sciences, Northumbria University, Newcastle upon Tyne, UK.
4. Faculty of Health, University of Canberra, Australia.

Corresponding Author

Graham Mytton

Sunderland College

Department for Sport and Enrichment,

Bede Centre,

Durham Road,

Sunderland.

SR3 4AH.

Tel: 0191 511 6182

Email: graham.mytton@sunderlandcollege.ac.uk

Preferred Running Head : Reliability and Validity of lap times

Abstract Word Count (193)

Text Only Word Count (797)

Number of Figures and Tables: 2

Abstract

The collection of retrospective lap times from video footage would be a useful research tool to analyse the pacing strategies in potentially hundreds of competitive events. The aim of this study is to validate a novel method of obtaining running lap time data from publically available video footage. Videos of the 1500m men’s final from the 2004 & 2008 Olympics, 2005 & 2009 World Championships and 2010 European Championships were obtained from You Tube and lap times collected from all competitors using frame by frame playback. Finishing times obtained from the video analysis were similar to official finishing times, the typical error of the estimate being 0.02%. The method was shown to be highly reliable showing a typical error of 0.2s (CV of 0.01%) when the same lap time data was collected on 2 occasions separated by 8 months. Video data of track races is widely available however camera angles are not always perpendicular to the start/finish line and some slower athletes may cross the line after the camera has panned away. Nevertheless the typical errors reported here show that, when appropriate camera angles are available, this method is both valid and reliable.

**Introduction**

Video playback is widely used in sport and exercise research in a variety of contexts including range of movement analysis, impact analysis, player and ball tracking as well as pacing. On the track, Le Meur *et al.*1 used video capture and playback to record the pacing strategies of modern pentathletes during a competitive event around an indoor track and Brown2 used a similar method to capture 800m and 1500m split times around a running track. These methods have the advantage of gathering competitive data and avoid the need for simulated races to be run in the laboratory. However these studies required a high level of access to international events and used a complex set up of three cameras positioned around the track.

Video footage of major events is available in the public domain and provides an extensive opportunity to obtain split time data of elite athletes during competitive events but without the expensive travel and set up costs of the methods described above. A search on the You Tube website revealed start to finish race footage was available for the vast majority of the major track meetings over the past ten years. An ability to use this freely available footage would be beneficial if a valid and reliable method were available to measure lap times. The aims of this study were to calculate the validity and intra-rater reliability of obtaining lap time data using public video.

**Methods**

**Data Collection**

Data was collected from five major international competitions between 2005 and 2011 in 1500m running events. Videos were only used when a static camera view of the start/finish line existed as athletes crossed the line on every lap. Videos were included from the 23rd and 24th Olympiads (Athens 2004 and Beijing 2008), the International Association of Athletics Federations (IAAF) World Championships in 2009 and 2005, and the European Athletics Championships in 2010. Sixty performances were analysed from these five events. A static camera view of the start/finish line was not available for the IAAF 2011 or 2007 World Championships or the European Athletics Championships in 2006. The videos were uploaded into Dartfish software and each athlete’s lap timed using the frame by frame playback facility. A screenshot of the collection method is shown on figure 1.

**Validity of the timing data**

Measured finish times were compared to the official results obtained from [www.iaaf.org](http://www.iaaf.org) or [www.european-athletics.org](http://www.european-athletics.org) for the 1500m running events. An excel spreadsheet3 was used to calculate a correction factor using linear regression. Validity was assessed using the Typical Error and a validity correlation coefficient.

**Intra-rater Reliability when collecting lap times from video**

The 2008 Beijing event was chosen at random from the five events where data had been collected from. The finishing times for each athlete were collected on two occasions separated by eight months and using the same researcher. Hopkins’ reliability spreadsheet4 was used to calculate the typical error and CV between these two separate data collections.

**Results**

**Validity of the timing data**

The correlation coefficient calculation resulted in r=0.99 and the Typical Error (± 90% C.I.) was 0.04s ±1.2s (CV of 0.02%). Linear regression using all 44 samples collected for the 1500m run calculated a correction equation of y = 1.012x -2.60 where y is the corrected value and x is the measured value, this is shown in figure2. It would be possible to correct all measured race times using this regression equation.

**Intra-rater Reliability when collecting lap times from video**

The Typical Error (±90% C.I.) between the finish times of the 2008 1500m Olympic final collected on two separate occasions was 0.02s (±0.02s) and the CV was 0.01%. This demonstrates that the method for collecting lap times using frame by frame video playback is highly reproducible.

**Discussion**

The analysis of running data shows a high agreement between the measured and official race times. It would be possible to correct all running race times using the regression equation formulated. However the typical error and CV values are so low as to make this correction negligible. Measured lap times should be accepted on this basis as a valid representation of the official time. In addition the method’s reliability was very good as shown by low typical error and CV values of the intra-rater reliability analysis.

This study has shown that use of freely available videos can dramatically increase the number of competitive events that can be analysed in pacing studies in an inexpensive way compared to studies that utilised similar methods but obtained the video in situ1, 2, 5, 6. Despite the simplicity of the methods, it retains validity and reliability as shown here. Researchers would be limited to using video clips providing the required start/finish line camera angle for each lap of the race which does not always occur.

Acknowledgements

The authors would like to thank Will Hopkins for his help with the statistical analysis using Typical Error and Coefficient of Variation. Graham Mytton would like to thank his employer Sunderland College for partial funding of his research.

*References*

1. Le Meur, Y., S. Dorel, Y. Baup, J.P. Guyomarch, C. Roudaut, and C. Hausswirth, *Physiological demand and pacing strategy during the new combined event in elite pentathletes.* *Eur J Appl Physiol*, 2012;112: 2583-2593.

2. Brown, E., *Running strategy of female middle distance runners attempting the 800m and 1500m "Double" at a major championship: a performance analysis and qualitative investigation.* *International Journal of Performance Analysis in Sport*, 2005;5: 73-73.

3. Hopkins, W. *Analysis of Validity by Linear Regression*. 2006 08/10/2006 [cited 2012 21/02/2012]; Available from: <http://www.sportsci.org/resource/stats/xvalid.xls>.

4. Hopkins, W.G. *Reliability Spreadsheet*. 2010 01/09/2010 [cited 2011 01/11/2011]; Available from: <http://www.sportsci.org/resource/stats/xrely.xls>.

5. Vleck, V.E., D.J. Bentley, G.P. Millet, and A. Burgi, *Pacing during an elite Olympic distance triathlon: Comparison between mate and female competitors.* *J Sci Med Sport*, 2008;11: 424-432.

6. Le Meur, Y., T. Bernard, S. Dorel, C.R. Abbiss, G. Honnorat, J. Brisswalter, and C. Hausswirth, *Relationships between triathlon performance and pacing strategy during the run in an international competition.* *Int J Sports Physiol Perform*, 2011;6: 183-194.

Figure Captions

Figure 1: collecting lap time data from video using Dartfish showing Balal Mansoor Ali of Bahrain crossing the line to complete the first 300m of the race in 00:41.42 seconds.

Figure 2. Linear Regression of measured and criterion 1500m run times.

Figures

Figure 1



Figure 2