ISBN 978-1-84626-032-2
Proceedings of 1st Joint International Pre-Olympic Conference of Sports Science & Sports Engineering
Volumen II: Bio-Mechanics and Sport Engineering
Nanjing, P. R. China, August. 5-7, 2008, pp. 193-198

An analysis of transition time in the World Championship of Triathlon - Hamburg 2007: Determination of the Lost Time T2.

Roberto Cejuela[1+], José A. Pérez Turpin[1], Juan M. Cortell[1],
José G. Villa Vicente[2]

[1]Departmental Section of Physical Education and Sports, University of Alicante, Spain.
[2]Departmental of Physical Education and Sports, University of Leon, Spain.

Abstract: Triathlon is a combined endurance sport, which includes back-to-back swimming, cycling and running, always in that order and with total time measurements including the transition between events. The speed and precision in the execution of the transitions is a major factor in performance described in the triathlon (Cejuela et al. 2007). In order to study the performance in triathlon we have taken into account that one of the most difficult (strategically and physically) part of a triathlon is the transition from cycling to running. The goal of the current study was to analyze the transition time during an international, top-level, competitive event (World Championship of Triathlon: Hamburg 2007), in particular the Lost Time T2 and its correlation with the final race scores. The results showed that the percentages of total time for each stage of the race and the corresponding transition times from stage to stage were: 16,5% for the swim, 0,64% for the swim-bike transition (T1), 52,1% for the bike-ride with a 0,33% of the time for the bike-run transition (T2), and finally 30,2% for the run. The correlation coefficients between stages and transitions relative durations, and the final classification scores were r=0.364 for the swimming stage, r=0.234 for T1, r=0.693 for bike-ride, r=0,284 for T2, and r=0.738 for the Lost Time T2. The run showed the strongest relationship with the final classification score (r=0,810). In conclusion, determining the Lost Time T2 may contribute significant information about the performance in high-level competitive Olympic Triathlon. The run seems to be a strongly related to performance success. Our results confirm prior suggestions made in the literature (e.g., Slelvert & Rowlands, 1996; Hue et al., 1998; Bentley et al., 2007).

Keyworks: Triathlon, Transition, Run, Swim, Bike, Correlation.

1. Introduction

Triathlon is a combined endurance sport, which includes back-to-back swimming, cycling and running, always in that order, and with total time measurements including the transition between events. Transition time refers to the lapse from swimming to biking (T1) and from biking to running (T2).

Thirty years have passed since triathlon was first conceived as a sport, and it has been officially by the International Olympic Committee and included as an Olympic sport since the Sydney 2000 Games. It was a resounding success, with numerous countries taking part in the inaugural event.

The distance of each of the phases in Triathlon (swimming, cycling and running) depends on the level of competition. However, the most common race is the Olympic Distance Triathlon (1.5 km swim, 40 km bike, and 10 km run). In order to study the performance in triathlon, we have taken into account that one of the most difficult (strategically and physically) parts of the triathlon is the transition from cycling to running.

+ Corresponding author. Tel.: + 34-139-5102 8086; fax: +34-25-8431 5757.
E-mail address: Roberto.Cejuela@ua.es

Transitions are a fundamental part of triathlon and have a large impact on the final result in many high-level competitive events. Some authors have assessed the duration of the transition phases (Sleivert et al., 1996; Hue et al., 1998) and reported times for elite tri-athletes at national or international levels that could be as short as >8 seconds per phase while considering a transition phase only actions carried out within the box. The first transition period T1 (swimming-to-biking) includes undressing the neoprene suit, put off the swimming hat and the goggles, and then wearing the protecting helmet while getting the bike. The second transition period T2 (biking-to-running) this includes parking the bike, undressing the helmet and wearing running shoes.

The speed and precision in the execution of the transitions is a major factor affecting the performance of a triathlon. The smaller the competition distance, the greater importance of transitions is. The percentage of time represented by transitions have been previously reported to be within 0,8-1,5% of the time measured in short triathlon Sprint competition (750 m swimming, 20 km cycling and 5 km run; Cejuela et al., 2007).

In the current study, we analyzed transition times during a top-level international competitive event (World Championship of Triathlon: Hamburg 2007), where we conjecture about the importance of the times of transition with regards to the final competition scores. Specifically, we hypothesized about the possible relationship between the time lapse T2 (Lost Time of transition bike-run) for each competitor with respect to the athlete that started the run first and the final competition rank.

2. Method

2.1. Procedures

The competition for analysis was the world Championship of Triathlon: Hamburg 2007, which was the highest level competitive event in the 2007 season with top-level participants that resemble those classified for the Olympic 2008 Games in Beijing. For the purpose of the analysis, we used the official split times for each phase (swim, bike, run) and transition periods (T1 & T2). The transition times were defined as the time lapse that took the athlete to change wear clothes, devices and/or equipment and move out of the area allocated for changing (i.e., the transition area).

For the purpose of the calculation of the above time differences between the lost time T2 with respect to the same time of the first individual that started the run, data were collected using a JVC GY-DV500E video camera orthogonally positioned with respect to the longitudinal direction of the track, at a distance of 50-m after the transition area between the cycling and running phases.

2.2. Statistical Analyses

Pearson correlation coefficients were computed between the times at the different stages of the event and the final rank results using a SPSS 14.0 software package. The alpha level for a significant p was set at ≤ 0.05.

3. Results and Discussion

The mean proportion of time (in %) with respect to the mean total event time for the competition was 16,5% for the swim, 0,64% for the swim-bike transition time (T1), 52,1% for biking, 0,33% for the bike-run transition (T2), and 30,2% of the time for running. This distribution for Olympic event triathlon distances resembles those shown for Sprint distance, whereas the values reported were 15-19% for the swimming stage, 48-54% for the biking stage, 25-31% for running, and 0.8-1.5% for the transitions T1 and T2, respectively (Cejuela et al., 2007). For the analysis of the Sprint Distance event the criterion of Millet and Vleck (2000) was used, where T1 comprised the time from the moment the athlete leaves the water till the first kilometre of biking, and T2 was measured from the last biking kilometre to the, first running kilometre. For the Olympic Distance event we use as a criterion the time lapse within the area of the transition box, from the moment an athlete passed across the entrance line into the box (where the bike was parked) and the moment when the athlete ran across the exit line from the same transition box.

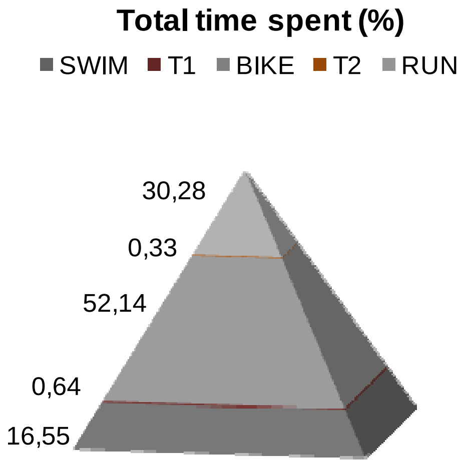

Fig. 1: The total time in % distributed among each stage (swim, bike and run) and the transitions (T1, T2).

We observed a weak correlation (r=0.364) between final ranking and the swimming time. During this stage, it seems rather important to end up in a favorable position for the later positioning among the leading biking peloton (Millet & Veck, 2000). During this stage, it is also important to swim behind leading athletes in order to exploit the hydrodynamic vacuum created and thus saving as much energy as possible for the rest of the event (Millet et al., 2002; Chatard et al., 1998).

Also the correlation between T1 and the final rank was weak (r=0.234), and this could be attributed to the fact that at this stage athletes may attempt to gain back during the biking stage some of the time lost in T1 while reaching the leading peloton. This is possible in triathlon because the landscape chosen for the event is often mildly hilly (no mountain biking) although sometimes there are some technical difficulties in the road (sharp curves, narrow passes). Therefore, Bentley et al. (2007) pointed out that the drafting in swimming and cycling may result in a deciding for a better tactical approach for increasing overall performance in elite Olympic distance triathlons.

The Lost Time T1 in this competition did not seem to be a determinant factor of the final rank. The flat characteristic of the landscape did not favour one athlete with respect to other athlete in the sense that the athlete that showed longer T1 could regain lost time in the following biking period. When the landscape is mountain-like as it may be the case in some competitive events, different and smaller biking pelotons may be formed. This may also diminish the influence of the drafting position.

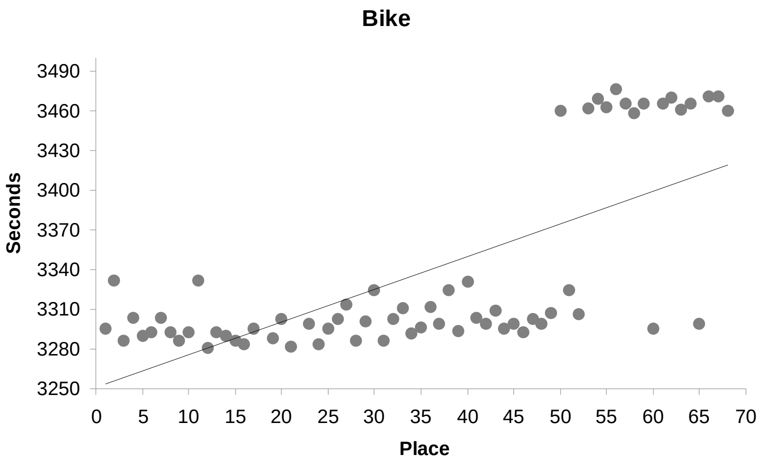

Fig. 2: Correlation between the time to complete the biking stage and the final ranking (r=0.693)

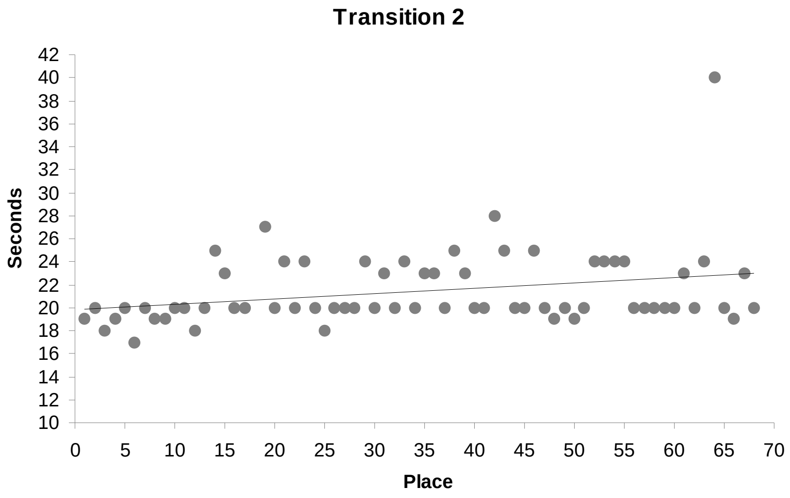

Fig. 3: Correlation between the time to complete the T2 and the final ranking (r=0.284)

The biking stage is the most tactical among all the triathlon stages, particularly in events that are not carried out along mountain slopes. In such conditions, athletes are grouped in pelotons, which follow different racing tactics. Normally, 2-3 pelotons are formed, and those that do not keep with the opening peloton are unlikely to be among the winners. The mean correlation between the time to complete the biking stage and the final ranking (r=0.693) may be indicative of such a situation (figure 2). This result strengthens the hypothesis forwarded by Bentley and colleagues (2007) regarding the importance of tactics during the biking stage. Figure 2 shows that the final time in the biking stage may allow for discriminating athletes in the first peloton from athletes in the second group, suggesting that final ranking may be completely determined by adherence to one or other peloton in this stage.

The second transition time T2 has been singled out as the most clear parameter associated with the final result in the competition (Millet & Veck. 2000). When a large number of athletes reaches the transition zone, the quick and neat change of clothing and devices becomes a major factor affecting the final result in the competition. We found, however, a weak correlation (r=0.284) between T2 and final ranking (figure 3), although transition time T2 is determinant of Lost Time.

Determination of the Lost Time T2 is the main contribution of the current study. It represents delays in seconds of the first athlete that starts the run after the transition T2 with respect to the rest of the athletes participating in the triathlon. The correlation coefficient between Lost Time T2 and final rank was relatively strong (r=0.738). A shorter time lapse waited in transition phases translates into a better final ranking (Figure 4).

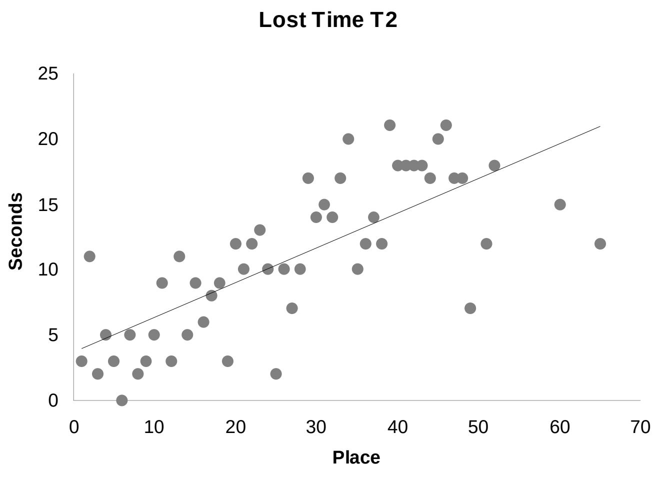

Fig. 4: The correlation coefficient between Lost Time T2 and final rank (r=0.738)

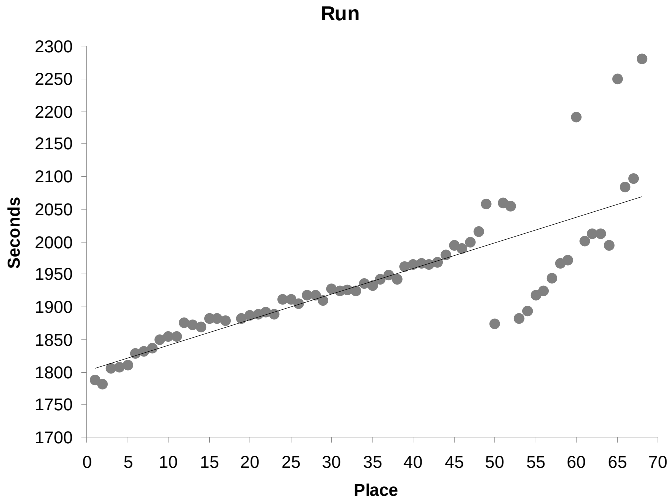

Fig. 5: The correlation between the time of the last running stage and the final rank (r=0,810)

Determination of the Lost Time T2 parameter enables gathering knowledge that coaches already knew it is important, although the relationship between such a parameter and the final ranking in a competition was not reported. Thus, it seems to be a factor that should be taken into consideration during the analysis of triathlon performance at top level.

It is important to note also that Lost Time T2 may be valid parameter for the determination of performance for athletes that reached the T2 zone with a single peloton.

Achieving a shorter Lost Time T2 may depend on two factors: first, it depends on whether the athlete is the first individual approaching T2 within his/her peloton, and second, it depends on performing the transition actions within the box in the shortest possible time.

In order to understand the importance of the Lost Time T2, we compare the measured times in each stage and transition for the athletes qualified in first and second place with their final times (Table 1). In the case of the individual ranked first, the time of the swim was longer (32” +), while the time T1 was a shorter time by 2 seconds compared with the individual ranked in second place. The second subject presented a delay of 37 seconds with respect to the time of the first subject in the biking stage, 1 second slower than the first subject in the T2, and longer time in the running stage, with respect to the first subject (+5”), which finally resulted in the best partial times for this stage among all participants.

POSITION	SWIM	T1	BIKE	T2	Lost Time T2	RUN	TOTALTIME
1	1058” 17’38”	36”	3295” 54’55”	19”	3”	1787” 29’47”	6198” 1h43’18”
2	1026” 17’06”	38”	3332” 55’32”	20”	11”	1782” 29’42”	6202” 1h43’22”

Table 1: Time used for each segment, transitions (T1 and T2), Lost Time T2 and Total Time in seconds.

The 7 seconds difference between the two athletes in Lost Time T2 is remarkable. It favored the first athlete qualified with respect to the second athlete, and it seems to be a determinant factor in the final time in the competition for this subject (1 hour, 43 min).

Regarding the final running stage of the triathlon, it is widely acknowledged in the literature that it is the most determinant factor in the performance (Slelvert & Rowlands, 1996; Hue et al., 1998, Bentley et al., 2007). The strong correlation (r=0,810) between the time of the last running stage and the final rank in the competition in the current study confirms this assumption (see Figure 5).

4. Conclusions

Determining the Lost Time T2 may provide important insights for an efficient competitive performance Olympic Triathlon at top level. It is a factor that can be trained, although it may be determined to some extent by order within the biking peloton at arrival at the T2 and the time used for action at T2.

The landscape of the biking circuit may change the overall significance of Lost Time T2. For flat circuit races with large numbers of athletes within one peloton, this parameter is determinant for further success, whereas in hilly or mountain slope or complex circuits its importance is reduced because the athletes are more dispersed, pelotons are formed by smaller groups of athletes arriving at T2 with larger time differences.

Finally, the running stage of the triathlon is the most significant in terms of the ability to predict success in the competition since the correlation coefficient showed a strong relationship between the time for running and the final total time (r=0,810). The result confirms previous information reported in the literature (Slelvert & Rowlands, 1996; Hue et al., 1998, Bentley et al., 2007).

5. References

[1] D. J. Bentley, G. R. Cox, D. Green, P. B. Laursen. Maximising performance in triathlon: Applied physiological and nutritional aspects of elite and non-elite competitions. Journal Sciences Medicine Sport. 2007, **12**.

[2] R. Cejuela Anta, J. A. Pérez Turpin, J. G. Villa Vicente, J. M. Cortell Tormo, J. A. Rodríguez Marroyo, An analysis of performance factors in sprint distance triathlon. Journal of Human Sport and Exercise. 2007, 2 (2): 1-25.

[3] J. C. Chatard, D. Chollet, G. Millet, Perfomance and drag during drafting swimming in highly trained Triathletes. Medicine Science Sports Exercise. 1998, **30**: 1276-1280.

[4] G. M. Dallan, S. Jonas, T. K. Miller, Medical considerations in triathlon competition. Sport Medicine. 2005, **35** (2): 143-161.

[5] O. Hue, D. Le Gallais,, D. Chollet, A. Boussana, C. Préfaut, The influence of prior cycling on biomechanical and cardiorespiratory response profiles during running in triathletes. European Journal of Applied Physiology. 1998, **77**: 98-105.

[6] G. P. Millet, D. Chollet, S. Chalies, J. C. Chatard, Coordination in front crawl in elite triathletes and elite swimmers. International Journal Sports Medicine. 2002, **23**: 99-104.

[7] G. P. Millet, and V. E. Veck, Physiological and biomechanical adaptions to the cycle to run transition in Olympic triathlon: review and practical recommendations for training. British Journal of Sport Medicine. 2000, **34**:384-390.

[8] S. Palazzetti, I. Margaritis, C. Y. Guezennec, Swimming and cycling overloaded training in triathlon has no effect on running kinematics and economy. International Journal of Sport Medicine. 2005, **26** (3): 193-199.

[9] G. G. Slelvert, D. S. Rowlands, Physical and physiological factors associated with success in the triathlon. Sports Medicine. 1996, **22** (1): 8-18.

[10] V. E. Vleck, D. J. Bentley, G. P. Millet, A. Bürgi. Pacing during an elite Olympic distance triathlon: Comparison between male and female competitors. Journal of Science and Medicine in Sport. 2007. 10.1016/j.jsams.2007.01.006