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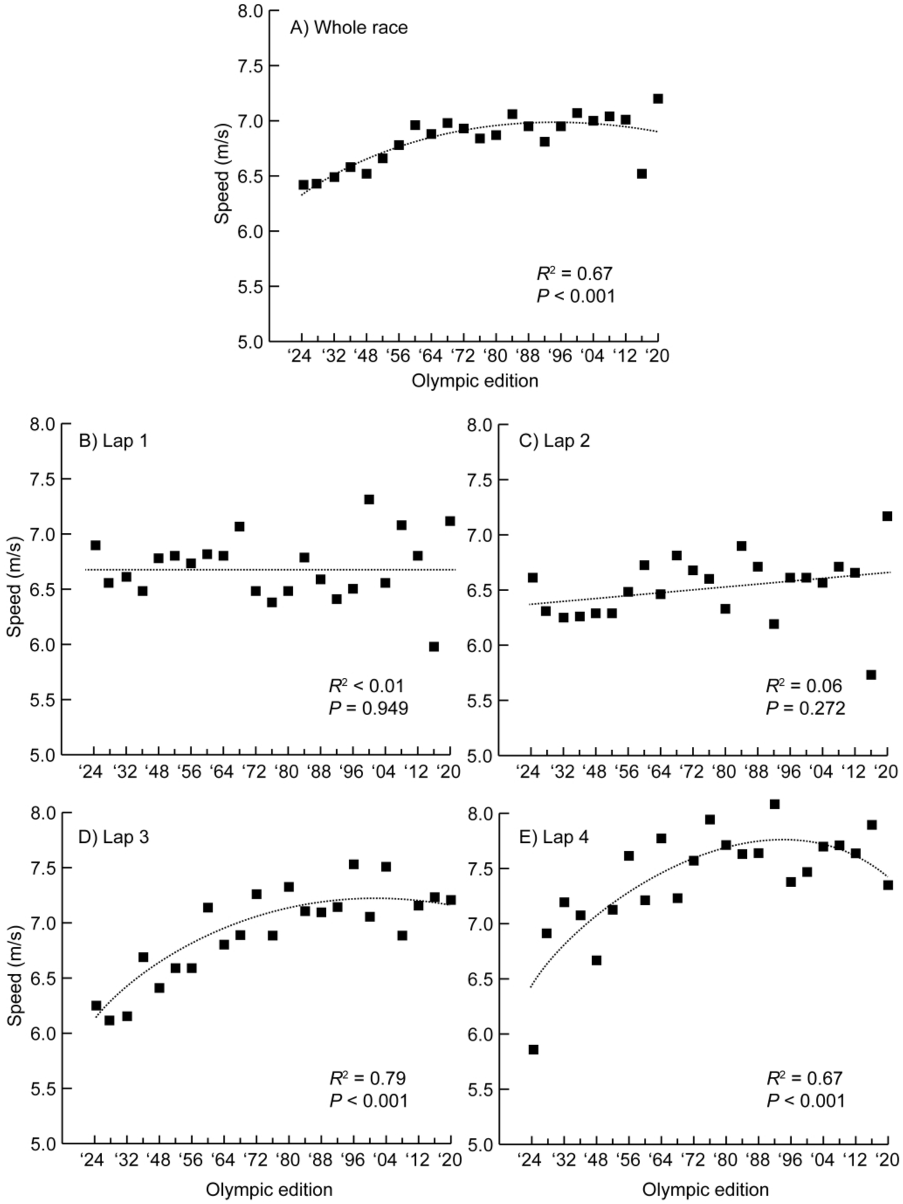

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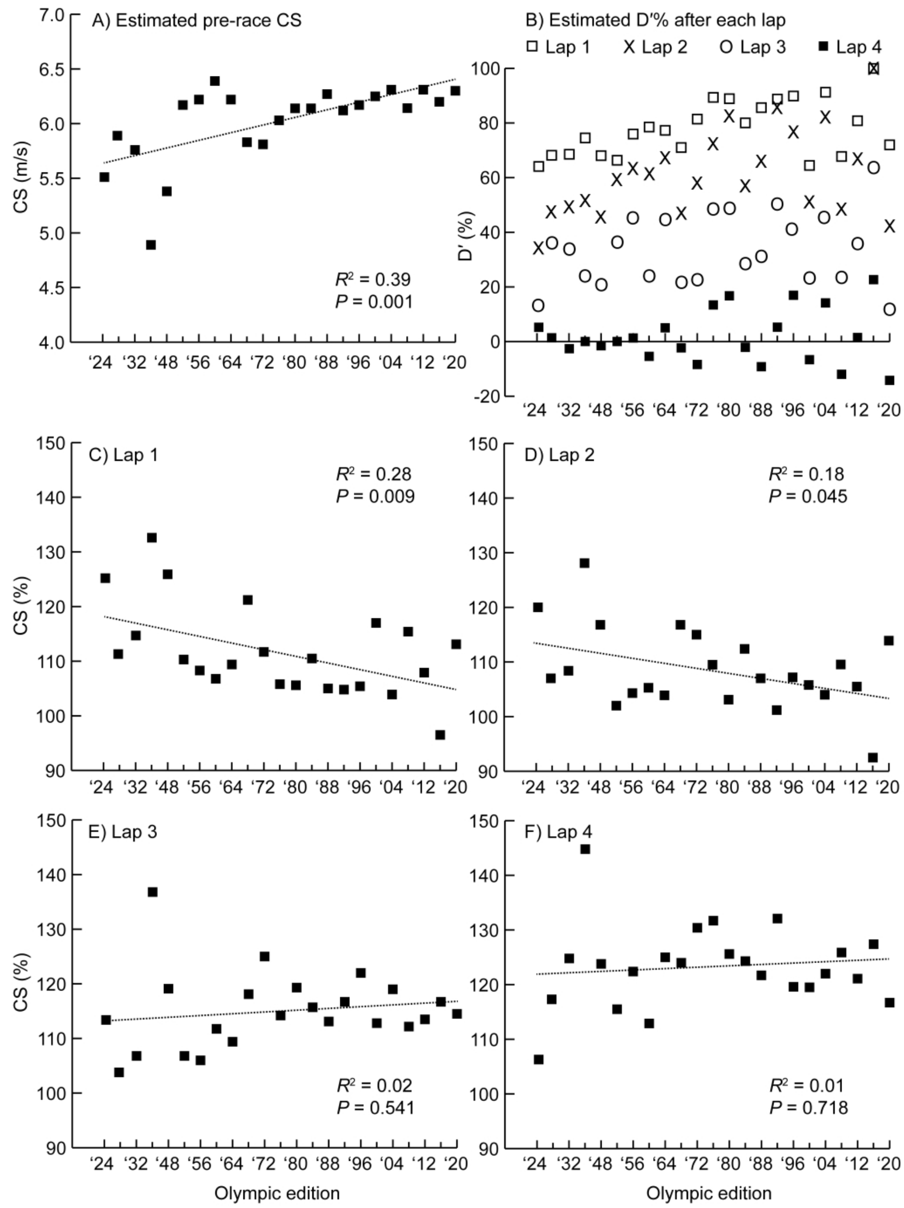

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Evolution of 1500m Olympic Running Performance

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Abstract

Purpose: This study determined the evolution of performance and pacing for each winner of the men's Olympic 1500m running track final from 1924-2020. **Methods:** Data were obtained from publicly available sources. When official splits were unavailable, times from sources such as YouTube were included and interpolated from video records. Final times, lap splits, and position in the peloton were included. The data are presented relative to 0-400 m, 400-800 m, 800-1200 m and 1200-1500 m. Critical speed (CS) and D′ were calculated using athletes' season's best times. **Results:** Performance improved ~25 s from 1924-2020, with most improvement (~19 s) occurring in the first 10 finals. However, only 2 performances were World Records, and only one runner won the event twice. Pacing evolved from a fast start–slow middle–fast finish pattern (reverse J-shaped) to a slower start with steady acceleration in the second half (J-shaped). The coefficient of variation for lap speeds ranged from 1.4-15.3%, consistent with a highly tactical pacing pattern. With few exceptions, the eventual winners were near the front throughout, although rarely in the leading position. There is evidence of a general increase in both CS and D′ that parallels performance. **Conclusions:** An evolution in the pacing pattern occurred across several "eras" in the history of Olympic 1500m racing, consistent with better trained athletes and improved technology. There has been a consistent tactical approach of following opponents until the latter stages, and athletes should develop tactical flexibility, related to their CS and D′, in planning pre-race strategy.

Key words: athletics, Olympics, pacing, racing, track

Introduction

Pacing, the work difference over time in endurance events, often discriminates amongst relatively evenly matched competitors, and is critical to whether a given athlete achieves improved performance.[1] Pacing is related to the distance[2-4] and mode[5] of exercise. Although early studies focused on self-paced activity,[6-8] more recent studies have focused on head-to-head competition,[9-11] and particularly on the decision-making process relative to changes in pace.[12-15]

Another approach has been the comparison of historical performances relative to the evolution of pacing strategy. These studies show that World Record (WR) performance typically evolves via more even pacing across time, although the pattern of pacing within a performer is remarkably consistent.[1,16, 18] A number of studies have focused on the 1500m (or 1 mile) as one of the marquee events in running.[17-25]

The men's 1500m is one of only 6 track events to have been held at every modern Olympic Games since 1896 and is considered one of its blue ribbon events. As a middle-distance event, success depends on managing both aerobic and anaerobic energy resources,[25] where the athlete must run fast enough to maintain a position close to the front,[24] but not so fast as to deplete anaerobic stores before the sprint finish.[10] Research has shown that success is influenced by how long athletes run above the critical speed (CS), which influences how much of the finite energy available that can be expended above CS (known as D′) remains as the race progresses.[1,10,26] While acknowledging that external conditions (e.g., track surface, equipment, weather) can greatly influence both performance and pacing, it seems reasonable to speculate that further information about the evolution of pacing will be instructive regarding the determinants of competition. Accordingly, we evaluated the evolution of performance in the men's Olympic 1500m track event over the past century. During this period, finishing times and lap splits for the winner were retrievable from online sources. Further, we used performances in other races during each Olympic time frame to estimate CS and D′ for each athlete. The aim of this study was to examine the evolution of performance and pacing in the men's Olympic 1500m final from 1924 to 2020.

Methods

Subjects. An observational design was used to analyze the performances of the Olympic men's 1500m champions (1924 – 2020). The gold medalists' names, nationalities, ages and finishing times are presented in Table 1, along with venue, date and Olympic edition. The mean age (± standard deviation) was 24.7 years (± 2.8), and the mean winning time (min:s) was 3:40.0 (± 0:07.5). As no prior 1500m personal record (PR) was available for the 1936 champion, we converted his 1-mile PR (4:07.6) to a 1500m time of 3:49.5 (a factor of 1.079) using the World Athletics scoring tables.[27] Including this converted time, the mean 1500m PR was 3:37.3 (± 0:08.5).

**** Table 1 near here ****

Data sources. Finishing times were obtained from online sources; in addition, split times were obtained at 400 m, 800 m and 1200 m. Complete winners' individual splits were available for: Snell (1964), Coe (1984) and Rono (1988) from the official reports for those Games (https://la84.org/6oic/OfficialReports, obtained via the Wayback Machine); for Kiprop (2008), Centrowitz (2016) and Ingebrigtsen (2020) from the World Athletics website (https://worldathletics.org/competitions/olympic-games); for Lovelock (1936) and Elliott (1960) from the World Athletics "Progression of World Athletics Records" eBook (https://worldathletics.org/news/news/progression-of-world-athletics-records-on-sal); for El Guerrouj (2004) from the Olympedia website (https://www.olympedia.org/); and for Keino (1968), Vasala (1972), Walker (1976) and Coe (1980) from the Athletics World Archive (http://www.todor66.com/athletics/index.html). Where available, electronic times (43%) were used for the split times; otherwise, official hand times (16%) were used. Because individual splits were recorded for the leader only in some editions, rather than the eventual winner, videos uploaded to YouTube were used (41%) to interpolate information obtained from the official reports for Barthel (1952) and Cacho (1992), and to supplement information from Olympedia for Delany (1956), Ngeny (2000) and Makhloufi (2012). Information combined from the official reports, Athletics World Archive and Olympedia were used to estimate split times for Larva (1928), Beccali (1932) and Eriksson (1948). YouTube footage alone was used to calculate split times for Morceli (1996). Unlike all other finals, which were held on a standard 400-m track, the 1924 race was held on a 500-m track, although splits were recorded at 400 m and 800 m; the 1200m split was not recorded and has been calculated using information from the Athletics World Archive, the official report, and video footage. The winners' PR and season's best (SB) times for events from 800m to 5000m for their winning year were obtained using the World Athletics website, Wikipedia and the Track and Field Statistics website (http://trackfield.brinkster.net/).

Data analysis. Individual SB performances at distances between 800m (~2:00) and 5,000m (~15:00) were used to estimate CS, CS relative to mean race speed (CS%) and D′ (adjusted to D′% to show the proportion of D′ remaining).[26] The race was divided for analysis using "laps": Lap 1: 0-400 m; Lap 2: 400-800 m; Lap 3: 800-1200 m; and Lap 4: 1200-1500 m. Because the last "lap" is shorter (300 m), mean speed was calculated for each section for statistical analysis. Analysis was conducted on both the absolute lap speeds (m/s) and lap speeds relative to mean race pace ("% race pace"). Coefficient of variation (CV%) was calculated using the mean and standard deviation of the lap speeds. Race performances were expressed as a percentage of each athlete's PR (PR%) and the concurrent WR (WR%). Historical WR pace data for each WR set from 1924 onwards were obtained from Casado et al.[21] Pacing profiles were assigned as either positive (speed declined lap-by-lap), negative (speed increased lap-by-lap), J-shaped (lap 2 was the slowest), reverse J-shaped (lap 3 was the slowest) or even.[6] Even pacing was defined as occurring when CV% was < 3%.

Statistical analysis. Data are presented as mean and standard deviation unless otherwise stated. Statistical analyses were conducted using SPSS Statistics 28 (IBM SPSS, Inc., Chicago, IL) with alpha set at $P < 0.05$. Regression analysis was used to find associations between athlete performance descriptors and years elapsed; a component had to be statistically significant at the 0.05 level and account for at least 5% of the variance in detection rate score to be retained in the final model, whereby a polynomial regression analysis was employed to fit the data with a linear or quadratic model, as appropriate. Coefficients of determination (R^2) have been reported for the regressions.

Results

A quadratic model showed that there was an increase in mean race speed (Figure 1A), manifested as a ~25 s improvement from the Olympic Record set in 1924 to the latest set in 2020 (Table 2).

In terms of absolute speed values, there was no change in mean speed for laps 1 or 2 (Figures 1B and 1C), but quadratic models showed that laps 3 and 4 became faster over time (Figures 1D and 1E).

**** Table 2 near here ****

**** Figure 1 near here ****

Each athlete's PR%, WR% and CV% are presented in Table 2. Seven of the 23 winning times were PRs, with 5 occurring in the first 11 finals. The mean PR% was 101.3% (± 2.5)(slower than PR) and a linear model showed an increase with time (winning times got progressively slower than PR pace) ($R^2 = 0.23$, $P = 0.020$). Two winning times (1936 and 1960) were WRs; the mean winning time was 102.4% (± 2.5) of WR, and a linear model showed an increase with time (winning times got progressively slower than contemporary WR pace) ($R^2 = 0.39$, $P = 0.001$). The mean CV% was 6.8% (± 3.1) and the regression analysis showed no change with time. The position within the running pack at the end of each lap is presented in Table 2. Most finals featured 12 athletes, although 9 started in 1960, 1964, 1976 and 1980, 10 in 1972, 11 in 1932 and 13 in 2016 and 2020. In general, the winners were near the front throughout the race, moved closer to the front with successive laps and, with 2 exceptions, were in the top 3 with 300 m remaining.

The pacing pattern observed in each race is presented in Table 2, along with racing eras that we allocated gold medalists to. We grouped the first 4 as "Pre-War" finals together with the 1948 "Austerity Games" given the lack of competition during World War II. The next 4 were grouped as the post-war amateur era, given many successful athletes of this time retired from track early to focus on professional careers. The early professional era began with the 1968 Games, the first to use a synthetic track and electronic timing, and the first final to feature many athletes from Africa. We assigned the finals from 1996-2016 as being North and East African-dominated, as 5 of the 6 champions represented Algeria, Morocco or Kenya.

The 3 earliest finals had either positive or reverse J-shaped profiles, with the 1928 and 1932 finals the only ones where lap 3 was the slowest, and 1924 one of only two (with 1948) where lap 1 was the fastest. J-shaped pacing became more prevalent before and during the post-war amateur era, but negative pacing was common during the early professional era and the beginning of the North and East African-dominated era. The finals thereafter were J-shaped until Ingebrigtsen's even paced win in 2020. The pacing pattern is different from mean WR pace, which is more symmetrical and has a smaller CV%.[21] The evolution of pacing across different eras is shown in Figure 2A. The average patterns evolved from a relatively faster first half to a relatively faster second half. There was a decrease in % race pace for lap 1 (quadratic model) and lap 2 (linear model) over time (Figures 2B and 2C). There was, by contrast, a linear increase in % race pace for lap 3 (Figure 2D) but no change for lap 4 (Figure 2E).

**** Figure 2 near here ****

Across all races, the mean CS was 6.02 m/s (± 0.36), which increased with time (Figure 3A), and the mean starting D′ was 182 m (± 60). The normalized D′% remaining in each athlete at the end of each lap is presented in Figure 3B, with a steady decrease in the absolute D′ value remaining lap-by-lap. There was no overall change in starting D′ across the 23 finals, but the D′% increased during laps 1 (linear model: $R^2 = 0.27$, $P = 0.010$) and 2 (linear model: $R^2 = 0.24$, $P = 0.019$), i.e., relatively more D′ remained after the first 2 laps in recent finals. The mean CS% over the whole race was 115% (± 6), which did not change over time, and CS% changed during the first 2 of the 4 laps over time (Figures 3C to 3F). The 2016 final was the only one where mean lap speed was below CS (on laps 1 and 2).

**** Figure 3 near here ****

Discussion

The aim of this study was to examine the evolution of performance and pacing in the men's Olympic 1500m final from 1924 to 2020. The first main finding was that performance in the 1500m evolved to a higher standard, improving ~25 s in 96 years. There was a rapid improvement of ~19 s in finishing time from 1924 to 1968, emphasized by the 8 (out of 10) Olympic Records set during this time, including 4 PRs and 2 WRs. The overall improvement in finishing times is likely attributable to 3 factors: a) a larger pool of runners as more athletes compete in the Olympics, b) improved training practices and enhanced professionalism amongst athletes,[28,29] and c) improved running surfaces and shoes.[30] However, the Olympic Record has improved only 3 times since 1968, with an absolute improvement in winning time of ~6 s up to 2020, with the quadratic model showing a relative plateau in performance after 1996. This is possibly unsurprising given the WR for the event has stood since 1998[21] and suggests that Olympic 1500m finals are unlikely to get much quicker. This finding emphasizes the need for intelligent pacing that is designed to win rather than achieve better times, i.e., that successful athletes are racers, not pacers.[31] By comparison, the WR in the 1500m has improved 39.1s (10.5 s from 1924 to 1968, and 28.6 s from 1968) to the present (set in 1998). In the 2023 Northern hemisphere track season, the 1500m records in both 1500m and 1-mile were challenged, and WR's for the 2000m and 3000m broken, but, the WR for the 1500m remains from 1998, supporting the concept that performance is unlikely to change greatly.

The second main finding was that pacing evolved from a fast start with slower speeds during laps 2 and 3 combined, with a relatively fast finish (in the pre- and post-war amateur eras), to a more contemporary pattern of a relatively slow start and a very fast finish (early professional and African-dominated eras) (Figure 2A). After 12 successive finals raced as negative or J-shaped pacing (1972 onwards), with the most extreme example of J-shaped pacing seen in 2016 (CV% = 15.3%), the very even-paced 2020 Olympic final (CV = 1.4%) represents either an outlier or a new pattern. The 2020 Champion has since finished twice over 1500m at World Championships where the winners' CV% were 1.8% and 4.0%, respectively (https://worldathletics.org/competitions), suggesting that the 2020 final did indeed herald a new pattern of more even pacing. Our earlier comment regarding improved running surfaces and shoes could be relevant here given the recent development of so-called "super spikes", which have been speculated to improve track running performance by up to 1.5%.[30] By contrast, there is less evidence of synthetic tracks improving performance beyond their first appearance in 1968, with only 2 athletes achieving a PR since those Games. A key factor in 2020 was that the winner, Ingebrigtsen, effectively had a pacemaker, Cheruiyot (KEN), who led for most of the race, not as a designated pacemaker but as part of his own tactical approach. Faster running results in a greater need for drafting, and Cheruiyot's approach could thus have helped Ingebrigtsen substantially. Overall, however, CV% did not evolve over the time period observed, directly opposite to the pattern of 1-mile WR performances.[18] It could be argued that, given that only 2 WRs were set in Olympic competition (1936 and 1960), the Olympic final is fundamentally a head-to-head race, and that athletes are more inclined to preserve resources for an all-out effort during the last 700 m than to expend their energy with maximal efficiency, which would occur in a WR attempt. This finding contrasts with the consistency in the fundamental pacing patterns of elite and recreational athletes where there was no change in CV% with improved individual performance.[16]

Regarding the preservation of resources until the second half of the race, we computed the CS and D′ from athletes' other races over 800m-5000m. This computation was difficult as athletes had fewer race results (particularly before 1970), ran a narrower "menu" of races, and had fewer races per year. It was also not possible to establish how maximal any SB was, given that athletes might have prioritized finishing position over time. However, we did successfully manage to evaluate CS and D′, showing as our third main finding that the pace during 1500m finals was consistently contested between 110-120% of CS and that the normalized D′ remaining decreased with each lap. This finding is consistent with the observation[10] that top athletes pace themselves to preserve D′ for an effort in the last part of the race, although it is also possible that athletes with smaller pre-race CS or D′ exhaust D′ earlier and are not in contention over the last 300 m. In practice, the 1500m has consistently been a race where athletes run at a certain percentage above CS on each lap, and a similar amount of D′ has therefore been preserved before the last 2 laps. The difference between the earlier and later eras, evident in the current data, but which contradicts Dekerle et al.,[32] is that CS increased, leading to improved finishing times. That some athletes reached negative values for D′ is likely attributable to imprecision in computing CS and D′ from prior performances and to the athletes being maximally fit on the day of the Olympic final (i.e., having a larger D′ than estimated from past performances). This is particularly evident after 1980, when it is possible that the use of bicarbonate acted to improve the physiological mechanisms as reflected by D′.[33]

Our fourth main finding was that the athletes destined to win the Olympic 1500m ran near the front of the pack for most of the race, ran closer to the front as it progressed, and with 2 exceptions were in the top 3 at 1200 m. This is consistent with prior findings in 800m and 1500m World Championship races[20,24] that athletes destined for medals moved to better positions as the race progressed, and were near the lead with 300 m remaining. Although we could not measure athletes' positions from the kerb, staying near the front could also help with avoiding being boxed in during the closing stages. We should note, however, that only 2 athletes led through all recorded splits and many winners were not in the lead at either 400, 800 or 1200 m (11 athletes). This suggests an advantage of following the pace set by others, which benefits because of a decrease in air resistance and because of the reduced psychological load of setting the pace.[34] Similar to our earlier comment about the 2020 final, it should be noted that Keino's 1968 win involved his compatriot Jipcho providing a fast-opening pace for 700 m, and that he benefitted from considerable experience of racing at high altitude (as in Mexico City), which is likely to have affected his decision-making process[12] in planning a fast, even pace to successfully challenge the physiological capacity of less-prepared rivals.

Over the past century, 22 men from 14 nations across Africa, Australasia, Europe and North America have won, with only one athlete (Coe in 1980 and 1984) winning twice. There appear to be eras grouping these athletes via common approaches to racing the 1500m. Although one could argue about when an era began or ended, it is clear that World War II exerted an influence, with 1948 being the first time in our analysis when the Olympic Record was not broken. After this era, the amateur ethos in competition was demonstrated by how many Olympic champions retired young (e.g., Elliott: age 22 years; Snell: 26; Delany: 27). We note that, in comparison with longer endurance events,[35] the 1500m is a young person's event, with a mean winner's age < 25 years. After the ending of strict "amateur" codes in the early 1970's, the early professional age began with advancements in technology and coincided with the emergence of outstanding African athletes. However, this era became dominated by "Western" athletes, partly because of boycotts between 1976-1984. The full emergence of North African and Kenyan champions began with Rono in 1988 and was most evident during the 1990's and 2000's (Table 2). One feature that was clear when calculating CS and D′ from SB times was that very few early winners had competed over 5000m, whereas more recently this distance has been covered in World-class times by several champions (e.g., El Guerrouj was 2004 Olympic 5000m Champion and Ingebrigtsen the 2022 and 2023 World 5000m Champion). Thus, the more recent pacing profiles prevalent in the event could be better suited to 1500-5000m types,[36] rather than 800-1500m types who dominated racing up until the mid-1960's.

Practical Applications

To win the Olympic 1500m final, athletes must be able to change pace in response to opponents' behaviors and have prepared for different pacing profiles. Historical developments and the more evenly paced 2020 Olympic final suggest that increasing CS and D′ in prior training and racing experience (across several distances) is a prerequisite for maintaining a fast pace (> 7 m/s). Coaches should note the importance of prior knowledge of CS and D′ in planning race tactics, which can be determined using race times[26] if time trials are not possible.[37] Athletes with lower CS might favor a slower approach in the early laps, but coaches must note that mean running speeds of 7.5 – 8.0 m/s over the last 300 m (37.5 – 40.0 s for that distance) are usually needed to win. World Records, Olympic Records and even PRs in Olympic finals are very rare given the varied pace of head-to-head racing, so athletes who are tactically aware, physiologically "flexible" (because of their CS and D′ values), and race frequently using a variety of pacing strategies[7,34,38] have an advantage.

Conclusions

As race times have improved over the last century, the pacing strategy for the men's 1500m Olympic race has evolved from a more "fast start" to a more "slow start" pattern. This has occurred in line with a general increase in both CS and D′. A relative plateau has occurred in winning times, showing that fine-tuning tactics is increasingly important in optimizing usage of available energy resources and outperforming rivals. Regardless of pacing profile, the eventual winners were nearly always near the front of the pack throughout. The occasional change in pacing profiles, as shown to occur between different eras, could be attributable to whether the 1500m winner is more of an 800m- or a 5000m-type runner.

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Figure Captions

Figure 1: Mean speed (m/s) in each Olympic final from 1924 – 2020 across the whole race (A) and for each of the 4 laps (B-E). Coefficients of determination (R^2) and significance values are shown for the regression analyses.

Figure 2: Comparison of pacing profiles for each identified racing era, expressed as a percentage of mean race pace (A); the data are offset slightly for clarity. The average pacing profile for World Records from 1924 to the present is also shown. The pattern of running speed across all Olympic finals, normalized to race pace, is also shown for each of the 4 laps (B-E). Coefficients of determination (R^2) and significance values are shown for the regression analyses.

Figure 3: Estimated pre-race CS (A), D′ and estimated D′% after each lap (B) for each Olympic men's 1500m final, as well as CS% on each successive lap (C-F). Coefficients of determination (R^2) and significance values are shown for the regression analyses conducted on the CS data.

Table 1 Details of each analyzed Olympic 1500m final. Finishing times that were recorded using hand timing are reported to 1 decimal place. Winning times that were Olympic records at the time are shown in bold and indicated by "OR"; those that were also World Records are indicated by "WR".

Venue*	Edition	Date of final	Gold medalist	Age (y)	Time (min:s)
Paris (FRA)	1924	July 10	Nurmi (FIN)	27.1	**3:53.6 OR**
Amsterdam (NED)	1928	August 2	Larva (FIN)	21.9	**3:53.2 OR**
Los Angeles (USA)	1932	August 4	Beccali (ITA)	24.7	**3:51.2 OR**
Berlin (GER)	1936	August 6	Lovelock (NZL)	26.6	**3:47.8 WR**
London (GBR)	1948	August 6	Eriksson (SWE)	28.5	3:49.8
Helsinki (FIN)	1952	July 26	Barthel (LUX)	25.3	**3:45.2 OR**
Melbourne (AUS)	1956	December 1	Delany (IRL)	21.7	**3:41.2 OR**
Rome (ITA)	1960	September 6	Elliott (AUS)	22.5	**3:35.6 WR**
Tokyo (JPN)	1964	October 21	Snell (NZL)	25.8	3:38.1
Mexico City (MEX)	1968	October 20	Keino (KEN)	28.8	**3:34.91 OR**
Munich (GER)	1972	September 10	Vasala (FIN)	24.4	3:36.33
Montreal (CAN)	1976	July 31	Walker (NZL)	24.6	3:39.17
Moscow (RUS)	1980	August 1	Coe (GBR)	23.8	3:38.40
Los Angeles (USA)	1984	August 11	Coe (GBR)	27.9	**3:32.53 OR**
Seoul (KOR)	1988	October 1	Rono (KEN)	21.2	3:35.96
Barcelona (ESP)	1992	August 8	Cacho (ESP)	23.5	3:40.12
Atlanta (USA)	1996	August 3	Morceli (ALG)	26.4	3:35.78
Sydney (AUS)	2000	September 29	Ngeny (KEN)	21.9	**3:32.07 OR**
Athens (GRE)	2004	August 24	El Guerrouj (MAR)	29.9	3:34.19
Beijing (CHN)	2008	August 19	Kiprop (KEN)	19.1	3:33.11
London (GBR)	2012	August 8	Makhloufi (ALG)	24.3	3:34.08
Rio de Janeiro (BRA)	2016	August 20	Centrowitz (USA)	26.8	3:50.00
Tokyo (JPN)	2020	August 7†	Ingebrigtsen (NOR)	20.9	**3:28.32 OR**

* Venues shown include the current nation name in which the host city is located.
† The Tokyo 2020 race was held in 2021.

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Table 2 The era during which the gold medalist won and their race performance expressed as a percentage of their personal record (PR%), expressed as a percentage of the concurrent World Record (WR%), coefficient of variation (CV%) and pacing profile. The position where each athlete was at the end of each lap (1: 400 m, 2: 800 m, and 3: 1200 m) is also shown ("Lap posn.").

Era	Gold medalist	PR%	WR%	CV%	Profile	Lap posn. (1,2,3)
Pre-War & "Austerity Games"	Nurmi (1924)	100.4	100.4	7.0	Positive	1, 1, 1
	Larva (1928)	100.3	101.0	5.3	Reverse J	1, 2, 3
	Beccali (1932)	99.6	100.9	7.2	Reverse J	5, 5, 3
	Lovelock (1936)	99.3†	99.6	5.2	J-shaped	7, 3, 2
	Eriksson (1948)	102.4	103.1	3.5	J-shaped	4, 3, 1
Post-war amateur era	Barthel (1952)	100.5	101.0	5.3	J-shaped	4, 5, 2
	Delany (1956)	99.9	100.3	7.5	J-shaped	9, 10, 10
	Elliott (1960)	99.8	99.8	3.7	J-shaped	4, 4, 1
	Snell (1964)	100.2	101.2	8.1	J-shaped	5, 4, 3
Early professional era	Keino (1968)	96.8	100.8	2.7	Even	3, 1, 1
	Vasala (1972)	99.8	101.5	7.2	Negative	4, 4, 2
	Walker (1976)	103.2	103.3	10.0	Negative	7, 4, 2
	Coe (1980)	103.0	103.0	9.5	J-shaped	2, 2, 2
	Coe (1984)	100.3	100.8	5.3	Negative	3, 2, 2
	Rono (1988)	100.2	103.1	6.7	Negative	11, 1, 1
	Cacho (1992)	103.8	105.1	12.3	J-shaped	4, 3, 3
North & East African dominated	Morceli (1996)	104.1	104.1	7.5	Negative‡	5, 4, 1
	Ngeny (2000)	101.6	102.9	5.3	J-shaped	3, 3, 2
	El Guerrouj (2004)	104.0	104.0	8.6	Negative	6, 1, 1
	Kiprop (2008)*	100.7	103.5	6.1	J-shaped	1, 1, 5
	Makhloufi (2012)	101.6	103.9	6.2	J-shaped	6, 6, 1
	Centrowitz (2016)	109.3	111.7	15.3	J-shaped	1, 1, 1
New evolution	Ingebrigtsen (2020)	99.8	101.1	1.4	Even	1, 2, 2

† Lovelock's PR% is based on a converted best 1-mile performance of 4:07.6 to a 1500m time of 3:49.5.

‡ Morceli's last lap was 2% slower than lap 3 (–0.15 m/s) and was the only final where lap 3 was fastest.

* Kiprop finished 2nd in the final but was subsequently elevated to the gold medal position when the original winner was disqualified for doping.

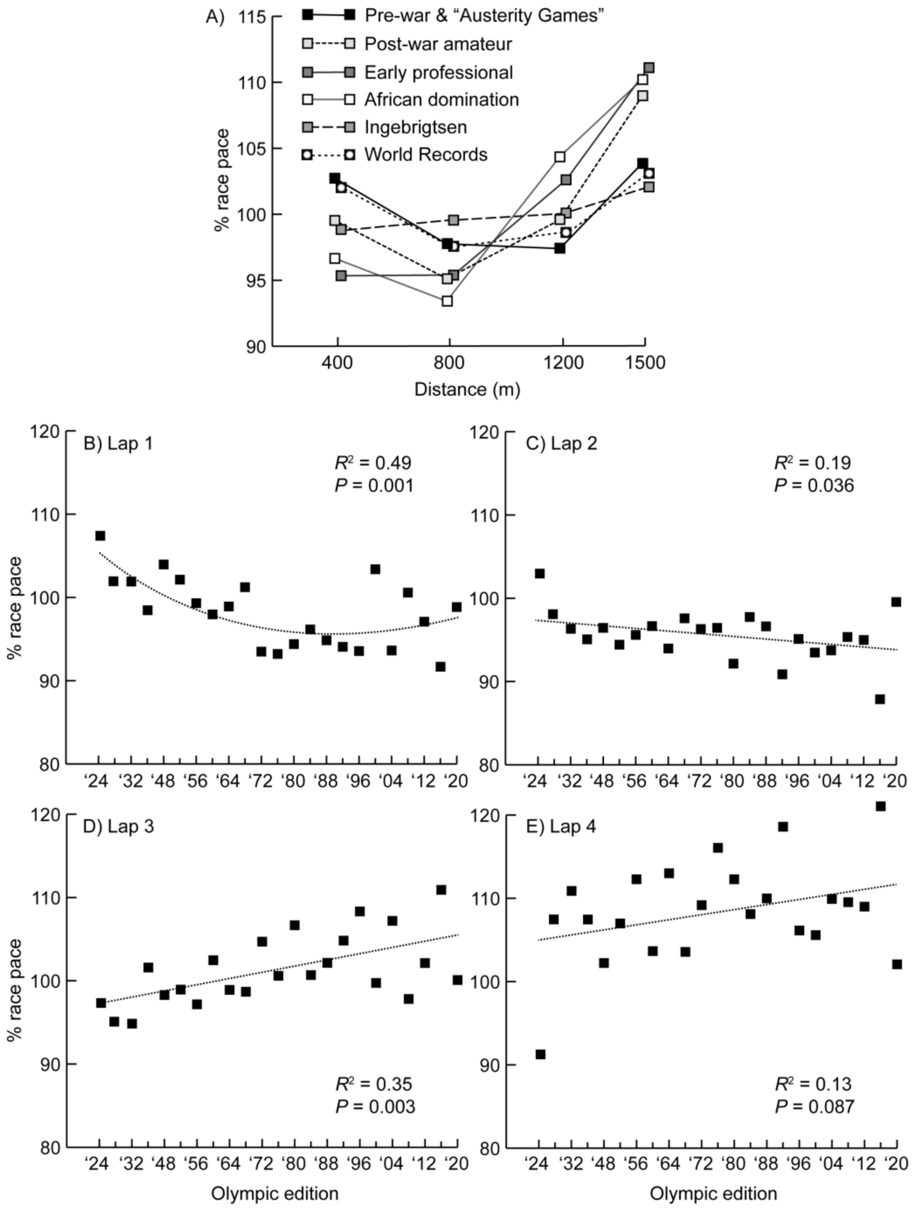

Fig 2

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