# Breaking Absolute Limits in Sports: Blessing or Blight?

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**Abstract**

Records are made to be broken. Marathon world records have been continually renewed for the past century. Our prime concern now is not *if* it is possible to break absolute limits of the record, but *when* we are going to witness that historic moment. By using statistical procedure this study attempts to make a prediction of the day when the marathon world record will reach its absolute limit of 0:00:00. It also examines the impact of that historic achievement on society and explores how it will change our life.

Berlin, September 28, 2014. The cheer from the crowd that gathered around the Brandenburg Gate got louder and louder as Dennis Kimetto, 30, approached the goal of the 26.2-mile stretch. The cheer rose to a crescendo when he crossed the finish line with both of his hands high above his head. The big LED board beside the finish line proudly displayed 2:03:00. The record barrier of 2:03:00, which had been thought impossible, was shattered. The crowd that gathered here were the witnesses of this historic moment.

Since marathon became an athletic competition, its record has been continually improved upon. When John Hayes ran in the 1908 London Olympics, he marked the record of 2:55:18, which surprised the people of that day. Dennis Kimetto had reduced the record by 55 minutes and 21 seconds in one hundred and six years.

Is the record that Dennis Kimetto marked the ultimate limit or is it to be renewed in the near future? Péronnet and Thibault (1989) have developed equations to predict the ultimate marathon record that athletes can achieve. They predict that the 2:02:00 barrier will be shattered no later than 2028, and by 2040 the record should drop to 1:57:18. The scientifically plausible limit, according to their prediction, is 1:48:25.

Joyner (1991) questions this prediction made by Péronnet and Thibault (1989) from the viewpoint of practical feasibility. According to Joyner (1991), there are three key factors that are crucial to athletic performance: efficiency of oxygen consumption, blood-lactate threshold, and running economy. Joyner (1991) argues that Péronnet and Thibault (1989) do not place these interrelated factors in proper perspective. Based upon his model Joyner (1991) predicts the ultimately feasible marathon record will be 1:57:58.

Brenkus (2011) has done an exhaustive research that includes the history of marathon, physiological requirements for an outstanding record, the psychology of athletes, and a thorough review of previous research by Péronnet and Thibault (1989) and Joyner (1991). Brenkus (2011) examines requirements for an ideal marathoner, which he breaks down into three components: optimal aerobic metabolism, efficiency of the muscles for utilizing fat, and the ability to store up carbohydrates. Brenkus (2011) concludes that these abilities can be developed through training even though some of these attributes are genetic. After a careful review of the work by Péronnet and Thibault (1989) and Joyner (1991) Brenkus (2011) supports the prediction made by Joyner (1991), who concludes that the ultimate possible marathon record is 1:57:58.

The best marathon record that exists as of 2017 is 2:02:57 that Dennis Kimetto made in 2014. Is this record ever to be broken? If it is, will it be the ultimate limit of the marathon record, or is that record also destined to be broken again. This question goes on endlessly.

In this study we will examine the historical progressions of marathon world records for the past century and attempt to predict the year when the record is expected to reach its perfection point, 00:00:00. We will also examine the impact of that historic achievement on society and explore how it will change our life.

## Method

### Data Collection

The data for this study were compiled from the lists of marathon records published by the International Association of Athletics Federations (IAAF), MarathonGuide.com, and other related sources. Tables 1 and 2 are the summary of data compiled respectively for men and women. The oldest reliable world record is 2:55:18 John Hayes marked at London Olympics on July 24, 1908. Dorando Pietri, an Italian runner, had actually crossed the finish line 32 seconds earlier than John Hayes, marking 2:54:46. Pietri, however, collapsed before the finish line and was aided by doctors. For this reason he was disqualified. For the sake of rigor we did not use Pietri's record for our data.

There exist older records than this, but they come from running a distance shorter than 26 miles and 385 yards. Before 1908 the distance run in the race was approximately 25 miles. People were more interested in who would arrive first than in the record the runners would make. The 1908 London Olympics was the first official marathon race in which athletes ran over the distance of 26 miles and 385 yards.

Table 1

*World Record Progression for Men*

| Date | Record Holder | Time | Seconds | Days |
|---|---|---|---|---|
| Jul 24, 1908 | John Hayes | 2:55:18 | 10,518 | 0 |
| Jan 1, 1909 | Robert Fowler | 2:52:45 | 10,365 | 161 |
| Feb 12, 1909 | James Clark | 2:46:52 | 10,012 | 203 |
| May 8, 1909 | Albert Raines | 2:46:04 | 9,964 | 288 |
| May 26, 1909 | Harry Barrett | 2:42:31 | 9,751 | 306 |
| Aug 31, 1909 | Thure Johansson | 2:40:34 | 9,634 | 403 |
| Jul 14, 1912 | Kenneth McArthur | 2:36:55 | 9,415 | 1,451 |
| May 31, 1913 | Alexis Ahlgren | 2:36:06 | 9,366 | 1,772 |
| Aug 22, 1920 | Johannes Kolehmainen | 2:32:36 | 9,156 | 4,412 |
| Oct 12, 1925 | Albert Michelsen | 2:29:01 | 8,941 | 6,289 |
| Mar 31, 1935 | Fusashige Suzuki | 2:27:49 | 8,869 | 9,746 |
| Apr 3, 1935 | Yasuo Ikenaka | 2:26:44 | 8,804 | 9,749 |
| Nov 3, 1935 | Sohn Kee-chung | 2:26:42 | 8,802 | 9,963 |
| Apr 19, 1947 | Such Yun-bok | 2:25:39 | 8,739 | 14,148 |
| Jun 14, 1952 | James Peters | 2:20:42 | 8,442 | 16,031 |
| Jun 13, 1953 | James Peters | 2:18:40 | 8,320 | 16,395 |
| Oct 4, 1953 | James Peters | 2:18:34 | 8,314 | 16,508 |
| Jun 26, 1954 | James Peters | 2:17:39 | 8,259 | 16,773 |
| Aug 24, 1958 | Sergey Popov | 2:15:17 | 8,117 | 18,293 |
| Sep 10, 1960 | Abebe Bikila | 2:15:16 | 8,116 | 19,041 |
| Feb 17, 1963 | Toru Terasawa | 2:15:15 | 8,115 | 19,931 |
| Jun 15, 1963 | Leonard Edelen | 2:14:28 | 8,068 | 20,049 |
| Jun 13, 1964 | Basil Heatley | 2:13:55 | 8,035 | 20,413 |
| Oct 21, 1964 | Abebe Bikila | 2:12:11 | 7,931 | 20,543 |
| Jun 12, 1965 | Morio Shigematsu | 2:12:00 | 7,920 | 20,777 |
| Dec 3, 1967 | Derek Clayton | 2:09:36 | 7,776 | 21,681 |
| May 30, 1969 | Derek Clayton | 2:08:33 | 7,713 | 22,225 |
| Dec 6, 1981 | Robert de Castella | 2:08:18 | 7,698 | 26,798 |
| Oct 21, 1984 | Steve Jones | 2:08:05 | 7,685 | 27,848 |
| Apr 20, 1985 | Carlos Lopes | 2:07:12 | 7,632 | 28,029 |
| Apr 17, 1988 | Belayneh Dinsamo | 2:06:50 | 7,610 | 29,122 |
| Sep 20, 1998 | Ronaldo de Costa | 2:06:05 | 7,565 | 32,930 |
| Oct 24, 1999 | Khalid Khannouchi | 2:05:42 | 7,542 | 33,329 |
| Apr 14, 2002 | Khalid Khannouchi | 2:05:38 | 7,538 | 34,232 |
| Sep 28, 2003 | Paul Tergat | 2:04:55 | 7,495 | 34,764 |
| Sep 30, 2007 | Haile Gebrselassie | 2:04:26 | 7,466 | 36,227 |
| Sep 28, 2008 | Haile Gebrselassie | 2:03:59 | 7,439 | 36,591 |
| Sep 25, 2011 | Patrick Makau | 2:03:38 | 7,418 | 37,683 |
| Sep 29, 2013 | Wilson Kipsang | 2:03:23 | 7,403 | 38,418 |
| Sep 28, 2014 | Dennis Kimetto | 2:02:57 | 7,377 | 38,782 |

Table 2

*World Record Progression for Women*

| Date | Record Holder | Time | Seconds | Days |
|---|---|---|---|---|
| May 23, 1964 | Dale Greg | 3:27:45 | 12,465 | 0 |
| Jul 21, 1964 | Mildred Simpson | 3:19:33 | 11,973 | 59 |
| May 6, 1967 | Maureen Wilton | 3:15:22 | 11,722 | 1,078 |
| Sep 16, 1967 | Anni Pede-Erdkamp | 3:07:26 | 11,246 | 1,211 |
| Feb 28, 1970 | Caroline Walker | 3:02:53 | 10,973 | 2,107 |
| May 9, 1971 | Elizabeth Bonner | 3:01:42 | 10,902 | 2,542 |
| Aug 1, 1971 | Adrienne Beames | 2:46:30 | 9,990 | 2,626 |
| Oct 27, 1974 | Chantal Langlace | 2:46:24 | 9,984 | 3,809 |
| Dec 1, 1974 | Jackie Hansen | 2:43:54 | 9,834 | 3,844 |
| Apr 21, 1975 | Liane Winter | 2:42:24 | 9,744 | 3,985 |
| May 3, 1975 | Christa Vahlensieck | 2:40:16 | 9,616 | 3,997 |
| Oct 12, 1975 | Jackie Hansen | 2:38:19 | 9,499 | 4,159 |
| May 1, 1977 | Chantal Langlace | 2:35:15 | 9,315 | 4,726 |
| Sep 10, 1977 | Christa Vahlensieck | 2:34:48 | 9,288 | 4,858 |
| Oct 22, 1978 | Grete Waitz | 2:32:30 | 9,150 | 5,265 |
| Oct 21, 1979 | Grete Waitz | 2:27:33 | 8,853 | 5,629 |
| Oct 26, 1980 | Grete Waitz | 2:25:42 | 8,742 | 6,000 |
| Apr 17, 1983 | Grete Waitz | 2:25:29 | 8,729 | 6,903 |
| Apr 18, 1983 | Joan Benoit Samuelson | 2:22:43 | 8,563 | 6,904 |
| Apr 21, 1985 | Ingrid Kristiansen | 2:21:06 | 8,466 | 7,638 |
| Apr 19, 1998 | Tegla Loroupe | 2:20:47 | 8,447 | 12,384 |
| Sep 26, 1999 | Tegla Loroupe | 2:20:43 | 8,443 | 12,909 |
| Sep 30, 2001 | Naoko Takahashi | 2:19:46 | 8,386 | 13,644 |
| Oct 7, 2001 | Catherine Ndereba | 2:18:47 | 8,327 | 13,651 |
| Oct 13, 2002 | Paula Radcliffe | 2:17:18 | 8,238 | 14,022 |
| Apr 13, 2003 | Paula Radcliffe | 2:15:25 | 8,125 | 14,204 |

**Measures**

In this study the chronological data were converted to the decimal system for the convenience of computation. The conventional notation using hours, minutes, and seconds, was converted the total amount of seconds. Thus John Hayes' record 2:55:18 will read 10,518 seconds. The amount of time that needed to renew the world record after John Hayes was converted to the total number of days. Dennis Kimetto, for instance, renewed the world record 38,782 days after John Hayes.

**Results**

Pearson product-moment correlation coefficients were computed to assess the relationship between the time that was required to run the distance of 26 miles and 385 yards and the number of days it took to achieve that record. There were positive reverse correlations between the two variables, $r = -.94$, $n = 40$, $p = .00$ for men, and $r = -.85$, $n = 26$, $p = .00$ for women. Figures 1 and 2 are scatter plots respectively for men and women.

**Figure 1**

*World Record Progression for Men*

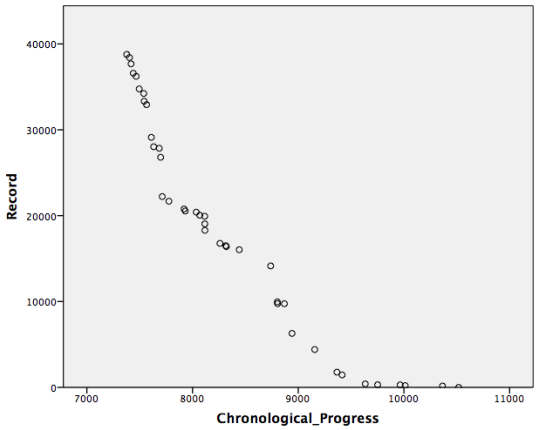
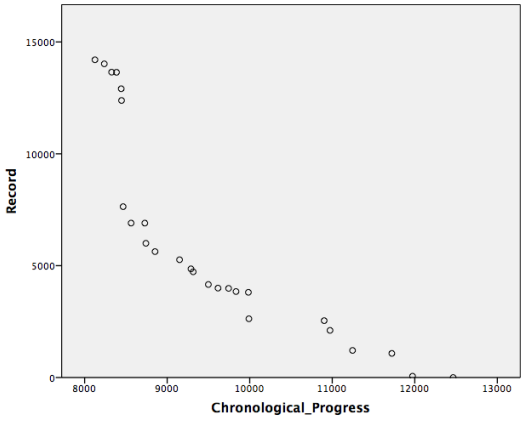



**Figure 2**

*World Record Progression for Women*




Simple linear regressions were calculated for men and women to predict the record based on the amount of elapsed time, which is represented by CP (Chronological Progress) in the following equation. For men, a significant regression equation was found ($F(1,38) = 312.411$, $p < .000$), with an $R^2$ of .892. The amount of time needed to run the distance of 26 miles and 385 yards measured in seconds is equal to:

-.067(CP)+ 9629.008 seconds

For women, a significant regression equation was also found ($F(1,24) = 60.990$, $p < .000$), with an $R^2$ of .706. The equation that predicts the record is:

-.233(CP)+ 10995.848 seconds

Now we are ready to answer the question: When will we achieve the ultimate world record of 0:00:00? It is January 16, 2302 (143716.41 days after July 24, 1908, when Joh Hayes marked the record of 2:55:18) for men, and November 22, 2432 (47808.00 days after May 23, 1964 when Dale Greg marked the record of 3:27:45) for women.

## Discussion

Is there an absolute minimum time to run a marathon? I there a point beyond which runner can no longer renew the world record? The answer is undoubtedly "no" as the history of marathon eloquently demonstrates and as the formulas above indicate.

The historic moment of marathon to be witnessed in the future will be January 16, 2302, when the world record will drop to 0:00:00. This means the instant the cannon blast signals the start of a 26.2-mile journey, the runner is crossing the finish line at the goal at the same time.

We can go a step further in our prediction. What will happen after the year 2302? When the starting cannon goes off, the runner will have already crossed the finish line. Here we will be facing a tough problem. The runner has crossed the finish line before the cannon blasts off. In other

words, the runner has already started before the official signal is given. Isn't this a false start and shouldn't the runner be disqualified? If the runner wants to avoid being disqualified, he or she will be required to run below the world record and cannot renew the record any more. This will eventually lead to the decline of marathon as an athletic competition, and herald the end of history of marathon.

There is, however, a bright side on this. Even though shattering the barrier of 0:00:00 leads to the decline of marathon, it will bravely open the door of physics into the future. The renewal of the world record after the year 2302 means that the runner is going back in history. We will be reversing the passage of time. For the first time in history human beings will be able to travel backward in time.

The impact of this astounding feat is not an achievement in physics alone. It will change every aspect of our social life. By traveling back in history we will be able to solve great mysteries that have remained unsolved. Who killed President John F. Kennedy? Did Atlantis really exist? The Roswell UFO Incident that supposedly took place in July 1947 in New Mexico a true story? Why did the dinosaurs die out? All these mysteries in history will be solved when we can go back in time.

There is no doubt the year 2302 is going to be a historic moment. We have to wait another two hundred years before the mysteries of history are solved. Yet it is not impossible to accelerate the pace to proceed to that moment. Marathon athletes can improve their physical and mental capacities with professional assistance from qualified coaches. Improved training facilities will also make a great contribution. When more government budgets are appropriated to the improvement of the resources for athletic training, we will be able to accelerate the pace of the world record renewal and should be able to witness the historic year before 2302.

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