Edwards, A., Guy, J. and Hettinga, F. (2016) Oxford and Cambridge boat race: performance, pacing and tactics between 1890 and 2014. Sports Medicine, 46 (10). pp. 1553-1562. ISSN 0112-1642.

Link to official URL (if available):

http://dx.doi.org/10.1007/s40279-016-0524-y

Article style: Original Research Article

Title: Oxford and Cambridge Boat Race: performance, pacing and tactics between 1890 and 2014.

Running title: Performance, pacing and tactics in the Boat Race

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Key points:

1. Oxford and Cambridge crews are now significantly faster and heavier in comparison to their racing predecessors
2. All crews in the 124 year sample displayed a fast start racing strategy
3. Obtaining an early advantage appears more meaningful than the selection of starting station despite undulations in the river course

Abstract:

Background: Currently no studies have examined the historical performances of Oxford and Cambridge Boat Race crews in the context of performance, pacing and tactics which is surprising as the event has routinely taken place annually for over 150 years on the same course. Objectives: The purpose of this study was twofold, to firstly examine the historical development of performances and physical characteristics of crews over 124 years of the Oxford and Cambridge Boat Race between 1890 and 2014 and secondly to investigate the pacing and tactics employed by crews over that period. Methods: Linear regression modelling was applied to investigate the development of performance and body size for crews of eight males over time from Boat Race archive data. Performance change over time was further assessed in 10-year clusters while 4 intra-race checkpoints were used to examine pacing and tactics. Results: Significant correlations were observed between performance and time (1890-2014) for both Oxford ($r = -0.67$; $p<0.01$) and Cambridge ($r = -0.64$; $p<0.01$). There was no difference in mean performance times for Oxford (1170 ±88s) and Cambridge (1168 ±89.8s) across 1890-2014. Crew performance times improved over time with significant gains from baseline achieved in the 1950s (Cambridge) and the 1960s (Oxford) which coincided with significant change in the physicality of the competing crews ($p<0.01$). There was no tactical advantage from commencing on either Surrey or Middlesex station beyond chance alone, however, all crews (n=228) adopted a fast start strategy, with 81% of victories achieved by the crew leading the race at the first intra-race checkpoint (24% of total distance). Crews leading the race at the final checkpoint (83% of total distance; 1143m) achieved victory on 94% of occasions. Conclusion: Performances and physical characteristics of the crews have changed markedly since 1890, with faster, heavier crews now common. Tactically, gaining the early lead position with a fast start strategy seems particularly meaningful to success in the Boat Race throughout the years, and has been of greater importance to race outcome than factors such as starting station.

1. Introduction:

The Oxford and Cambridge Boat Race is one of the oldest, continuing sporting events in the world,[1] with great history and which is watched annually by ~15 million people worldwide.[2-3] Historically as well as scientifically, the race is of unique value, as performance data have been collected in the same event over 2 centuries: the ideal set-up for a field-based longitudinal evaluation. The first heavyweight men's eights race between the two universities was held in 1829 at Henley-on-Thames, before going through various transitions and moving to the current course in 1863.[2-3] As such it is surprising that no in-depth analysis of historical performances or tactical and pacing profiles of the Boat Race exists in the scientific literature. This omission presents an intriguing opportunity to investigate the development of performance, pacing, and tactics over an extensive period in a single head to head team racing event.

Analysis of the historical developments in the Boat Race provides a unique opportunity to better understand factors relevant for optimal performance. For example, the ability to sustain physical work for prolonged periods underpins successful performance in many endurance sports, most of which have been deliberately designed to maximally tax the physical limits of the participants.[4-6] To be able to perform races faster, changes to training techniques, diet, technology, and competitor characteristics have all evolved over time and undoubtedly contribute to improved performance.[7-9] Anecdotal evidence also indicates the physical characteristics of the respective crews are likely to have changed although this has not yet been documented in the scientific literature. This is perhaps a reasonable assumption as the race now largely involves international level competitors, drawn from undergraduate and postgraduate students enrolled at the two universities.[1] Therefore, the purpose of the first part of this investigation is to document and statistically compare the development of performance in the Boat Race over the period in which data are largely uninterrupted, except where allowing for major external events such as war and occasional boats sinking due to adverse weather conditions.

A secondary aim of the present study is to examine the optimal pacing strategies and tactics employed by race crews in this unique event of head to head team competition and whether specific patterns are associated with successful performance.[10-12] Crews may win or lose the race depending on the pacing strategy they employ and how they tactically address the event.[6] Pacing is therefore an important process of decision-making over how and when to invest energy in the knowledge of the duration, the race circumstances and the competitors' physical capabilities.[13-14] During the race, the athletes must respond to events dynamically as they unfold, while still being aware of their physical capabilities, the demands of the event, their opponents' actions,[15-16] tactical considerations, and the level of physical discomfort they are prepared to endure.[6]

In comparison to cycling and running, rowing has received comparatively little scientific research on pacing and performance [17-20] and the unique form of head to head competition of two teams directly racing against each other in the Boat Race has thus far remained unexplored. The present study will use a unique longitudinal dataset available on performance, pacing and tactical profiles of athletes competing in a head to head team competition, to provide insight on how performance, performance characteristics, pacing and tactics have developed throughout the late nineteenth, twentieth and twenty-first centuries.

2. Methods:

2.1 Participants

All participants in the Boat Race crews were adult males, with crews comprising eight males and a male or female coxswain. All crews were enrolled as either undergraduate or postgraduate students at Oxford or Cambridge universities. There was no limit on the number of occasions in which a participant could compete in the race, with one competitor having appeared in six races (1978-83).

2.2 Data collection and analysis

The historical development of performance over time was measured by collecting information on race characteristics in the form of performance times and intra-race landmark checkpoints, derived from the independent race archives held by the Boat Race Limited.[21-22] All reported performances were recorded under the central timekeeping of the Race Marshall using a system of increasing electronic complexity and sophistication between the 1800s and 2014. Independent archive records were also obtained for rower characteristics in the form of body mass recorded for each competitor prior to each race and reported in the public Boat Race archives. No other data of physical characteristics were available.

Subsequently, performance time data were scrutinised from the first race in 1829 to 2014 in order to compare the evolution of performance, tactics and pacing profiles in the Oxford and Cambridge Boat Race. However, the early races from 1829 were sporadic, not held yearly and were not performed on the current course (Figure 1). In 1845 the race moved to its current location, although races in 1846, 1856, 1862, and 1863 were held in the opposite direction between Mortlake and Putney. In addition, there were four unofficial boat races held during

World War II away from London. Gaps were present in data due to World War I (1915-19) & II (1940-45) events and occasional ad hoc issues such as boats sinking (1912 both crews; Oxford 1925, 1951; Cambridge 1978, 1984), although 2 of the races where boats sank were rescheduled 1-3 days later (1951, 1984).[2-3]

To examine pacing profiles, crew timings at 4 intra-race checkpoints (landmarks) were compared for all races as these were used consistently throughout the 1890-2014 period (1: Mile Post, 2: Hammersmith Bridge, 3: Chiswick Steps, 4: Barnes Bridge and the Finish) (Figure 1). In addition, the pacing strategy in terms of section times of the crews was considered in accordance with 1) the overall profile across checkpoints and 2) the degree to which all crews sought to gain tactical advantage during the race. This was investigated by assessing each crew's average boat speed (m/s) across the full course (6.8km) and comparing the crew's average speed between checkpoints.

Detailed intra-race performance times that are required for our pacing analysis such as checkpoint times were not available until 1890.[3] Therefore for the purpose of this investigation, race outcomes from 1890 to 2014 have been analysed both as raw results for linear regression analysis and also collated into decade by decade (e.g. 1890-1899) comparisons to enable statistical evaluation of evolutionary change for both Oxford and Cambridge. Collating data into 10 year averages for statistical difference testing between decades minimised the impact of factors such as adverse weather conditions, variation of tide or stream on one-off races and other extenuating circumstances beyond the scope of the project. Use of raw (complete) data between 1890-2014 enabled in-depth evaluation of important intra-race characteristics of pacing and also tactical characteristics, such as race outcomes according to different starting stations (i.e. Middlesex or Surrey), which may offer advantages to crews at different stages of the race due to undulations in the river course. Of the three bends in the river course, crews commencing on the Middlesex station potentially have the advantage of the first and last bend, while crews on the Surrey station have the inside racing line on the large middle bend of the river. The precise distances and course layout are shown in Figure 1.Results were thus not only analysed according to Oxford and Cambridge performance comparisons, but also by starting station and intra-race positional advantage to assess tactics and pacing strategies employed.

2.3 Statistical Analysis

Linear regression analysis was performed on raw performance and body mass data across the full data range for both Oxford and Cambridge between 1890 and 2014. Associations between data sets were examined using Pearson product moment correlations. Basic descriptive statistics (mean and SD) were used to characterize decade by decade comparisons with respect to both the final time and that of each intra-race checkpoint. To evaluate categorical data and the impact of factors such as starting station and the extent of fast start strategy employed, chi squared analyses were performed. Repeated measures analyses of variance (ANOVA) were performed to examine whether or not statistically significant differences existed between performances across different decades. The normality of the data was confirmed by the Greenhouse-Gaesser test. The Bonferroni post hoc test was used to make pairwise comparisons between decades where ANOVA indicated a significant overall effect. Statistical significance was accepted at $p<0.05$. Data in figures are displayed ±SEM.

3. Results:

3.1 Historical development of Boat Race performance

Linear regression analysis identified significant correlations between performance time and the year of the race for both Oxford ($r = -0.67$; $p<0.01$) and Cambridge ($r = -0.64$: $p<0.01$) (Figure 2a). There was no difference between mean performance times for Oxford (1170 ±88s) vs. Cambridge (1168 ±89.8s) across 1890-2014. ANOVA evaluation identified that Cambridge was the first University to experience a significant positive change in performance from baseline (1890s decade) which occurred in the 1950s ($p<0.05$) (Figure 2b). Oxford achieved a significant change from baseline (1890s) in the 1960s decade ($p<0.05$). Both universities subsequently further improved again in the 1980s (Oxford $p<0.05$; Cambridge $p<0.05$). The progressive improvement in performance trend continues to the current sample, culminating in a substantially shorter performance time for both Cambridge from 1890 to 2014 (1326s vs. 1148s respectively; 13.4% improvement) and Oxford (1323s vs.1116s respectively; 15.6% improvement) (Figure 2a & 2b).

Linear regression analysis demonstrated that body size was significantly related to time elapsed (1890-2014) for both Oxford ($r = 0.78$; $p<0.01$) and Cambridge ($r = 0.83$; $p<0.01$), (Figure 3a). In the 1890s, average crew body masses (77.2kg) were the same for Oxford and Cambridge and by 2014 had increased to 87.8kg for Oxford and 92kg for Cambridge, demonstrating a 14% change and 19% change respectively. ANOVA identified that Cambridge's first significant change in average crew body mass occurred in the 1930s decade ($p<0.01$) (Figure 3b). The next significant change for Cambridge occurred in the 1960s, then the 1990s and in the 2000s. Oxford's first increase in average crew body mass occurred in the 1950s ($p<0.01$), increasing again in the 1960s, the 1980s, and also in the 2000s (Figure 3b).

3.2 Pacing and tactics in the Boat Race

All crews (n=228) demonstrated a fast start pacing profile to the race as determined by achieving their fastest boat speed in sector 1 to the Mile Post (Figure 4a). Therefore, the magnitude of fast start was investigated by categorising the extent to which the first sector was faster than the respective crew's average boat speed. By using a normal distribution approach to determine the most common strategy, the analysis indicated the greatest prevalence was demonstrated for a pace that was 10-15% higher in sector 1 compared to average boat speed across the race (Figure 4b).

Comparison of pacing profiles (Figure 4a) across all decades demonstrated a consistent crew pattern for a fastest first sector of the race, followed by a plateau of steady performance times for each remaining sector. There was no evidence for a common final end spurt, or parabolic style of pacing model. However, closer inspection of all instances where crews remained in close racing proximity (within 3s – approximately half a boat length) at the final intra-race checkpoint (Barnes Bridge) (n=13 races, n=26 crews) revealed a final sector that was on average 1% faster than respective average boat speed, compared with an average 2% slower final sector across all other races. Of the 26 crews sampled (n=13 races), 15 crews demonstrated an end spurt (57.7%).

To examine tactical factors, the effect of starting station on performance was investigated by analysing the winning chances associated with starting stations. This revealed that there was not a systematic pattern of success for Middlesex or Surrey beyond that of chance alone, although starting on the Surrey station resulted in victory on 55% (n=63/114) of all occasions compared to 44% (n=51/114) compared to Middlesex. However, the mean performance times from Middlesex (1170 ±86.5s) and Surrey (1167 ±89.5s) stations were only 3s different across 1890-2014.

Evaluation of intra-race checkpoint times and likelihood of winning the race revealed that the positional advantage of being the leading crew at checkpoints 1 & 2 was of similar importance (80-81% chances of winning) (Table 1). The chance of winning grew to 85.7% only after leading at the third checkpoint, while by the final checkpoint at Barnes Bridge, the leading crew won on 93.6% of all occasions. Further analysis was undertaken to evaluate whether or not intra-race positional advantage was influential to performance when coupled with starting station (Table 2). This revealed that the positional advantage of being the leading crew at checkpoints 1 and 2 was of similar importance (80-86% chances of winning) from both starting positions although the greatest occurrence of race victories occurred from the Surrey station (Table 2). However, in instances where crews remained in close proximity at the final checkpoint, crews starting the race on the Middlesex station achieved victory on 41/42 occasions (97.6%) from that position.

4. Discussion:

The main observations of this study related to historical development of Boat Race outcomes throughout the past 124 years demonstrate that both performances and the physical characteristics of Oxford and Cambridge crews changed significantly over time. As an overall effect, it is easy to discern a substantial improvement to performance between the years 1890-2014 for both sets of crews by examination of the linear regression model (Figure 2a) since 1890, which culminates in ~14% improvement (~160s faster than the 1890s). This gain in performance is accompanied by an average increase in body mass of ~15kg (~19%) per athlete. Such large changes to performance and body mass of the crews are in contrast to the pacing strategies employed by the crews, which seem largely unaltered across decades (Figure 4a). It is evident that all crews (n=228) employed a fast start pacing strategy,[6,10] with normal distribution tending to support an opening pace in the first sector of the race to the Mile Post ~10-15% faster than the average race pace. This is a strategy also common to shorter distance (2000m) Olympic multi-lane style rowing racing, [17-18] but is in contrast to most exercises lasting longer than 2 min.[11,23]

There are many factors that have influenced performances over the history of the Boat Race.[2-3,24] Although training data were not available for this report, factors such as training styles, duration, frequency and intensity are common contributory features to historical improvements in all sporting performances.[1,24-25] Other influences such as the introduction of the sliding seat (1870s) and advances in boat and oar technology have also contributed to performance gains.[3] Modern crews now race in lightweight, rigid, carbon-fibre racing boat shells and cleaver-style oars [2-3,22] which are far more conducive to fast times compared to equipment available in the 1800s. However, despite contemporary races being among the fastest recorded in the history of the event, decade by decade evaluation has not yet indicated a further significant improvement from the performances of the 1980s, although change is likely when considering the strong linear relationship between performance and time (Oxford: r = -0.67; Cambridge: r = -0.64).

A common evolutionary change for crews from both universities has been the increase in body size. In 1890, the average body mass of the crews from both universities was 77.2kg, which was similar to that of the general population at that time.[27] Crews are now considerably heavier than that (2014: Oxford = 87.8kg and Cambridge = 91.9 kg) although still beneath the average crew body mass of Olympic 2000m heavyweight competitors ~102kg.[18,19-20] Being of a large and muscular size would be particularly advantageous at the start of the race to achieve acceleration and rowers are estimated to utilise approximately 70% of their muscle mass because all extremities and the trunk participate in the propulsion of the boat.[28] Therefore it is unsurprising that body mass has increased over time at a similar rate to performance improvement. Correlational analysis between performance and body mass demonstrates a highly significant negative relationship for all crews ($r= -0.89$; $p<0.01$), supporting the view that heavier, and thus assumingly more muscular, crews tend to perform most effectively in the Boat Race.

In terms of tactics and pacing, the starting station for the race did not identify a statistical advantage beyond that of chance alone for crews on either position. However, commencing the race on the Surrey station resulted in greater overall victories compared with Middlesex, although historically there was only 3s mean difference between performances from the two stations across 1890-2014. Nevertheless, all crews achieved a faster than average-race boat speed in the first race sector and gaining the lead position at the first checkpoint resulted in a better winning chance. This presents a important positional advantage and also suggests the race outcome is often determined after only 24% of the race distance is completed (i.e. distance to checkpoint 1). This is consistent with multi-lane rowing events where it is widely acknowledged that gaining placement at the front of the race is tactically and psychologically advantageous.[18] In multi-lane racing, a fast start enables the rowers to monitor the position of other boats, manipulate effort and respond to any alterations in pace from other competitors.[17] This is also the case in head to head racing, where being in the lead can additionally mean taking the preferential racing line from the opposition, while also giving the trailing crew disturbed (wake) water which disrupts the balance, aerodynamics and consequent pace of the boat.[8-9,18,28] This is in contrast to performance in other head-to-head competitive sports such as short-track speed skating where, in the final stages of the race, the trailing rider has a clear aerodynamic advantage of drafting in the slipstream of the preceding competitors.[15-16] As previously found when comparing cycling with skating,[29] pacing strategies might differ related to the specific nature and characteristics of the different sports.

The use of a fast start strategy in the Boat Race is in contrast to other endurance events of similar duration. [11, 23] For cycling events longer than 4000m an even-paced strategy is typical and energetically most favourable [11] and this is also the case for performances in longer distances of speed skating (up to 10km). [23] Therefore, an even-paced strategy would be expected to be optimal for a 6.8km rowing event. However, Boat Race crews all demonstrate a fast start and this appears to be associated with winning: athletes thus choose a different strategy than they are expected to when rowing alone (just as track athletes competing over short distances choose a different strategy for tactical reasons than when running alone). Tactical elements are consequently of decisive importance for factors such as avoiding the wake of the preceding boat, and choosing the optimal stream: as both boats are on the same course, they have to compete for the optimal position.

Evaluation of the extent to which a fast start was employed in the Boat Race did not identify a singularly effective strategy. Indeed, a pace of 10-15% above average race speed for the first sector was common for both winning and losing crews (Figure 4b). An obvious difficulty of commencing the race too fast is the issue of sustaining pace to the finish line.[6,30] and therefore the results of the study provide additional evidence to suggest that athletes balance between choosing an energetically optimal profile and the tactical benefits that play a role in head to head competition in a specific sport, as previously demonstrated in short track speed skating.[15-16]

Although establishing an early lead appears the optimal strategy for the race, there remains a positional advantage late in the race for crews on the Middlesex station if they are in the leading position at Barnes Bridge (checkpoint 4; 83.1% of total race distance). From that position, crews have achieved victory on 41/42 occasions (98% of wins) (Table 2). This is undoubtedly due to the positional advantage on the inside of the final bend in the river, coupled with the stage in the race when the rowers are most fatigued. However, simply being ahead in the race at this late stage (1143m distance remaining; 94% winning chance) further supports the view that the leading position, once established, is rarely changed.

A considerable challenge in head to head racing vs. time trial or multi-lane racing is the extent to which one responds to the behaviour of the opposition. Different pacing strategies of the opponents will evoke different responses, emphasizing the interdependence of perception and action.[13] The presence of an opponent tends to result in a faster performance and in the first stages of the race, a fast starting opponent will evoke a faster, more energetic start.[31] Responding to an externally derived pace is more physically challenging than self-regulating pace [32] and thus the potential responsiveness required over the 6.8km course Boat Race considerably adds to the demands of racing and the development of fatigue. Nevertheless, the reduction in boat speed observed after the first sector (Figure 4a) implies that crews may retain physical capacity to ensure they do not experience catastrophic fatigue [30] prior to the finish of the race. Extrapolation of races where crews were in close proximity of each other at the final checkpoint (n=13 races; n=26 crews) identified that an end spurt is possible (n=15/26 crews; 58% of the sample). However, as 94% of all crews leading at the final checkpoint go on to win the race, it appears that an end spurt is rarely required. The distance between the final checkpoint and the finish (1143m) is still substantial and it is possible that further evidence of end spurts may be hidden within the distance to be covered, although it seems more likely that race order is usually well established at that point and an end spurt is not necessary for the majority of race outcomes. Consequently, the overwhelming factor of tactical importance seems to be attaining an early lead, an advantage which is rarely ceded.

5. Conclusion:

Performance in the Boat Race has evolved substantially since 1890 and this has been accompanied by changes to the body mass of the competitors. While there is no significant historical difference between the performances of the crews (Oxford mean time: 1170 ±88s; Cambridge mean time: 1168 ±89.8s), pacing and tactics are clearly meaningful. Pacing profiles seem largely consistent across generations, albeit now faster with the clearest objective being to establish an early lead. This strategy seems counter-intuitive compared to other endurance events of similar duration, and thereby reflects the importance of the tactical advantages associated with leading the race such as avoiding the wake of the preceding boat and choosing the optimal stream. Although commencing the race from the Surrey station resulted in 55% of all victories, there is not a systematic pattern of success from either station beyond that of chance alone, with only 3s between performances from Middlesex (1170s ±86.5s) or Surrey (1167s ±89.5s) across 1890-2014. Therefore, the primary strategy for success appears to start fast, gain a lead at the first checkpoint (24% of the race duration) from where an 81% winning chance exists.

Compliance with Ethical Standards

Funding

No sources of funding were sought or used to assist in the preparation of this article.

Conflicts of Interest

Andrew Edwards, Joshua Guy and Florentina Hettinga declare that they have no conflicts of interest relevant to the content of this review.

Ethical Considerations

Data were retrieved from previously published public databases with the support of the Boat Race Ltd and did not contain personal information. Since this analysis relies exclusively on publicly available data it is exempt from Institutional Review Board review requirements.

Acknowledgements: The authors would like to acknowledge the support of the Boat Race Limited and the Boat Race archivist in the preparation of this manuscript.

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Figure Captions:

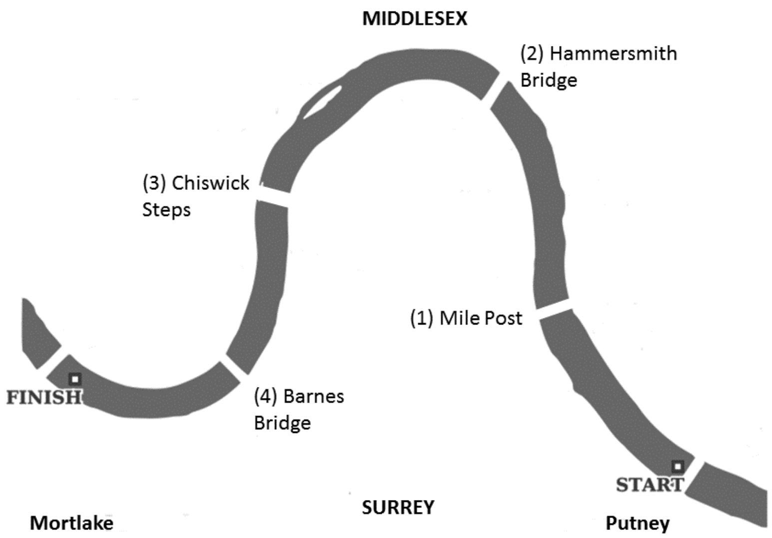
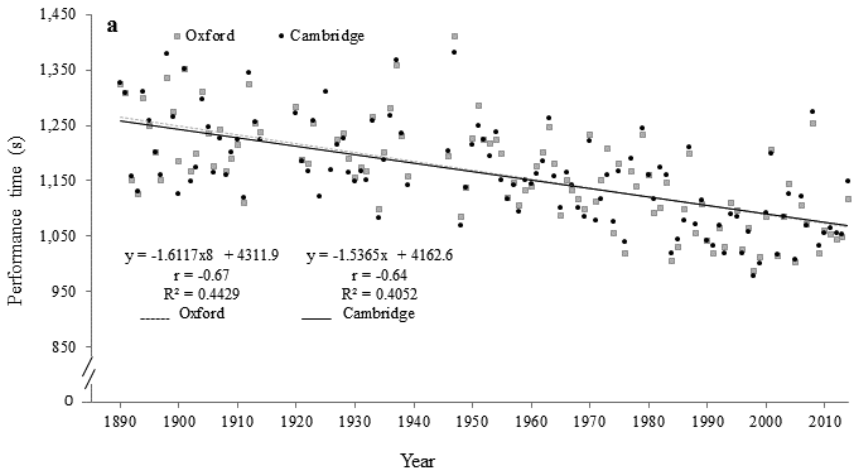


Figure 1. The Boat Race course and the intra-race timed checkpoints.
Distances:
Start to (1) Mile Post: 1760 yards (1609.3m) (23.7% of the race)
Mile Post to (2) Hammersmith Bridge: 1180 yards (1079m) (39.7% of the race)
Hammersmith Bridge to (3) Chiswick Steps: 1590 yards (1453.9m) (61.1% of the race)
Chiswick Steps to (4) Barnes Bridge: 1634 yards (1494.2m) (83.1% of the race)
Barnes Bridge to Finish: 1250 yards (1143m)
Total: 7414 yards – 4 miles 374 yards (6779.4m)



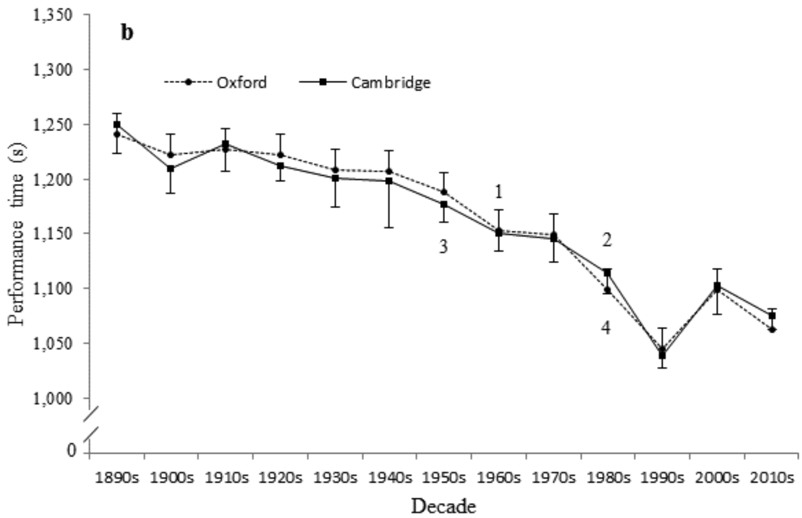


Figure 2. (a) Raw performance times for Oxford and Cambridge crews by year (1890 – 2014). Gaps in lines depict either missing data for both crews such as over World War I & II, or missing data due to a boat sinking.
Figure 2. (b) Mean ± SEM decade by decade performances for Oxford and Cambridge.
1: Oxford crews were first significantly faster compared with baseline (1890s) in the 1960s (p= 0.033)
2: Oxford crews were significantly faster again in the 1980s compared to the 1960s (p=0.039)
3: Cambridge crews were first significantly faster compared with baseline in the 1950s (p=0.048)
4: Cambridge crews were significantly faster again in the 1980s compared to the 1950s (p=0.03)
SEM = standard error of the mean

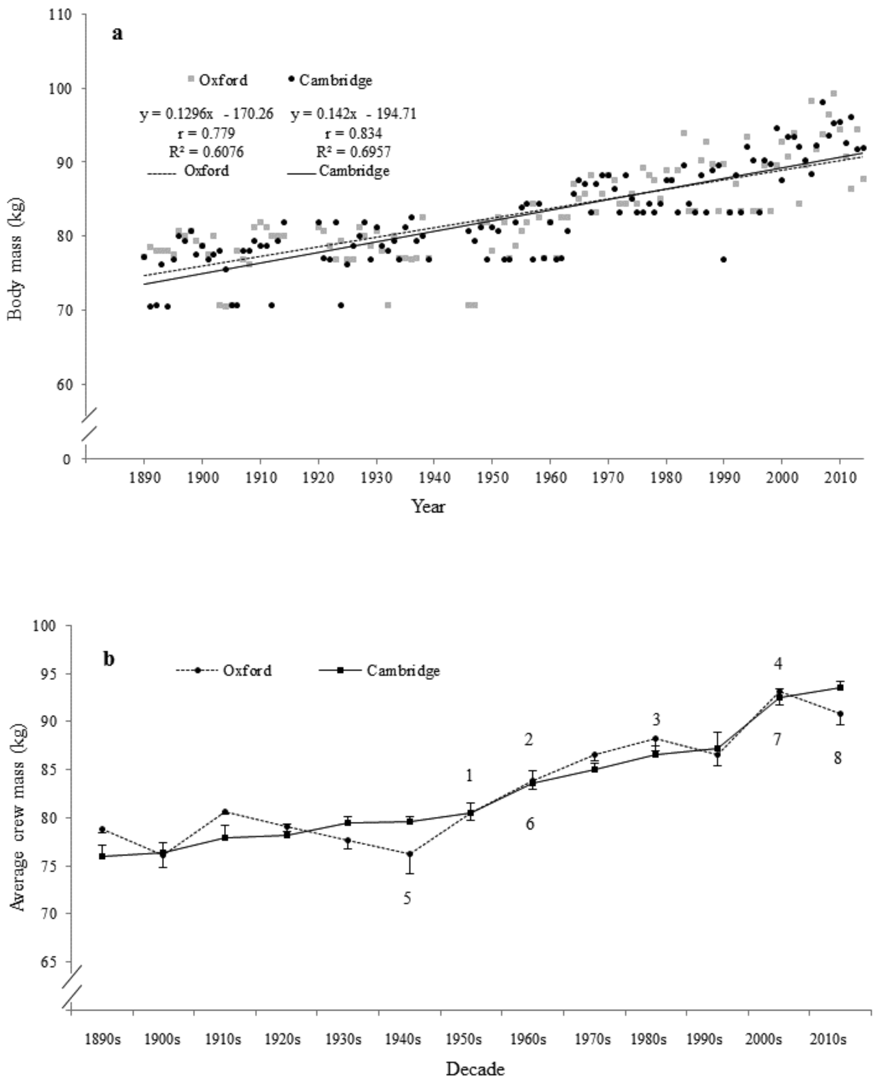
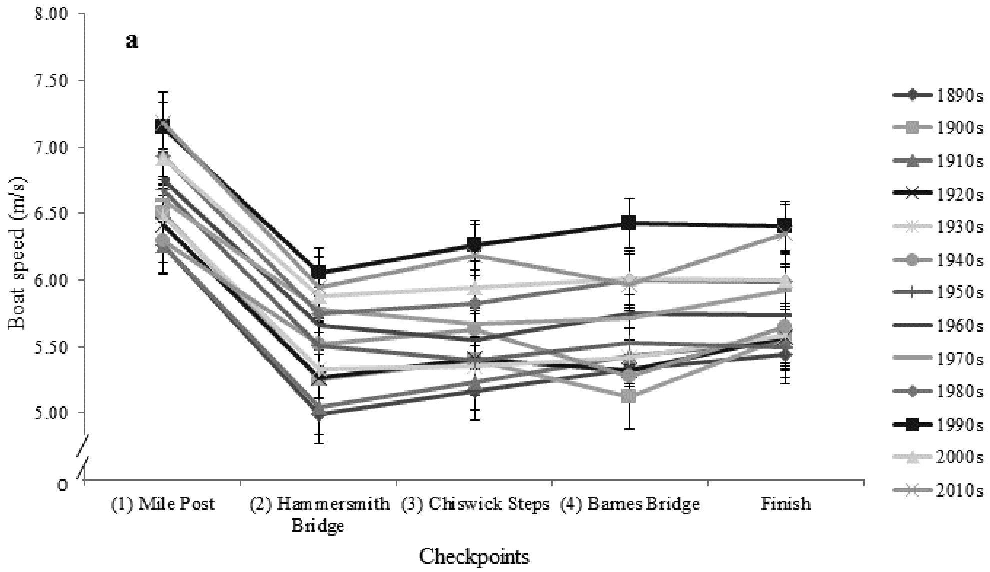
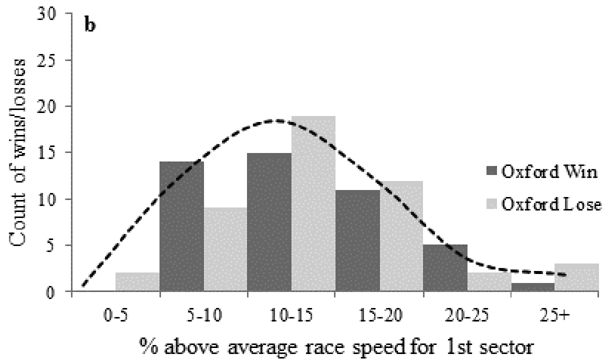


Figure 3. (a) Linear regression of crew body mass and time (1890-2014). **Figure 3. (b)** Crew body mass in decade by decade averages for comparison of change. Means are displayed ± SEM
1: Oxford crews were first significantly heavier compared with baseline (1890s) in the 1950s ($p= 0.043$)
2: Oxford crews were again significantly heavier in the 1960s compared to the 1950s ($p=0.029$)
3: Oxford Crews were heavier again in the 1980s compared to the 1960s ($p=0.030$)
4: Oxford Crews were heavier in the 2000s compared to the 1990s ($p=0.005$)
5: Cambridge crews were first significantly heavier compared with baseline (1890s) in the 1930s ($p= 0.008$)
6: Cambridge crews were again significantly heavier in the 1960s compared to the 1930s ($p=0.016$)
7: Cambridge Crews were heavier in the 1990s compared to the 1960s ($p=0.047$)
8: Cambridge Crews were heavier in the 2000s compared to the 1990s ($p=0.007$)
SEM = standard error of the mean





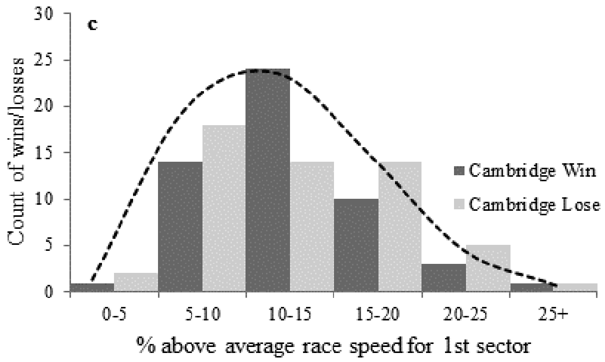


Figure 4. (a) Mean (± SEM) pacing profiles for Oxford and Cambridge as evaluated by decade averages. **Figure 4. (b)** Win, loss and distribution of fast start pacing strategy employed by all Oxford crews across 1890-2014 for the first sector of the race (Start to Milepost). **Figure 4. (c)** Win, loss and distribution of fast start pacing strategy employed by all Cambridge crews across 1890-2014 for the first sector of the race (Start to Milepost).
SEM = standard error of the mean

Table 1. Win percentage by position at each intra-race checkpoint marker

Intra-race checkpoint	Win %[a] from this position
(1) Mile Post	80.6 ($p<0.001$)
(2) Hammersmith Bridge	80.4 ($p< 0.001$)
(3) Chiswick Steps	85.7 ($p< 0.001$)
(4) Barnes Bridge	93.6 ($p< 0.001$)

a: Win % is calculated irrespective of starting station and University

Table 2. Percentage of race victories achieved from different stations, when leading at each intra-race checkpoint.

Win (%)							
Surrey starting station				Middlesex starting station			
Leading at Mile Post	Leading at Hammersmith Bridge	Leading at Chiswick Steps	Leading at Barnes Bridge	Leading at Mile Post	Leading at Hammersmith Bridge	Leading at Chiswick Steps	Leading at Barnes Bridge
84.3	80.0	84.1	89.2	81.3	84.8	91.7	97.6
(43/51)	(56/70)	(58/69)	(58/65)	(26/32)	(28/33)	(33/36)	(41/42)

Data in brackets = wins achieved from the total number of leading positions at the respective checkpoint.