

Determining the Factors of the Increase in speed of Swimmers*

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ABSTRACT

This paper provides evidence that the increase in the speed of modern swimmers is due to the increase in age of these athletes. Most people believe that as an athlete grows older their performance will decrease. However, this may not be entirely true because research has shown that the average age of most swimmers entering the Olympics has increased yet, personal and world records are still being broken in all events.

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1 INTRODUCTION

Competitive swimming started in Britain around 1830 but, the sport did not make it to the Olympics until 1896. Since then much has been added to and changed with the sport. For example, when the sport first started out the only events were freestyle and breast-stroke. Since then two more strokes have been added to the sport, backstroke and butterfly.

Swimming is a very competitive sport just like track where the times come down to milliseconds. It is just like many races in other sports where it is difficult to shave even half of a second off your personal record but, we constantly see these athletes improving at each Olympic games. There must be something that they are doing to constantly increase their speed. Being a swimmer for 16 years and competing in multiple state events I always thought that the key to improving was through form and technique. However, recent research has shown that this increase in speed of swimmers may be due more to age than anything else. It is common knowledge that as we age our performance in all sports decreases. However, this rate is not a constant decline, it is shaped more like a parabola where your performance increases as you age until you hit a certain peak and then your performance decreases. "In swimmers, the age-related decline in performance was reported to be influenced by the race distance and differed between women and men for short-distance pool-swimming" (Rust, pg 2). This article discusses how

women reach their peak performance quicker than men do. This seems to imply that men are capable of performing better at a higher age than women are for short races such as the 50m events. "In ultra-endurance swimming, peak swimming performance was achieved between 30 and 39 years for both men and women" (Rust, pg. 2). This evidence supports the claim that Olympic swimmers are increasing their speed due to them entering into the Olympics at older ages.

My first step in my research was to look for a data table that had all the world records ever set in swimming. However, due to the purpose of this paper I decided to only take data for 50m events. I did this because speed in swimming is showcased through sprints not endurance races. After collecting the data for each stroke I combined the data into one big data table using excel. This table displayed useful information but I still needed to add data of my own so that I could manipulate the data charts in Jupyter to support my claim. My second step in my analysis was to find articles that supported my claim. Each researcher has done studies, provided data, or provided visualizations that help prove that swimmers are getting faster because of their age.

The reason that scientists believe that Olympic swimmers are still breaking personal and world records at such a high rate is because these athletes are performing closer to their peak performance years. For every athlete there is a point in time where he or she will be at their max potential. Most athletes reach this point anyway because they peak at a young age. However, male swimmers usually do not reach this pinnacle because studies done by "Fairbrother (2007) reported that the peak swimming performance for 50 m freestyle was achieved at an older age in men" (Rust, pg. 2) yet, most men do not compete at this age. Nonetheless, male swimmers are beginning to enter into these races at older ages every year. Through the data I have collected it is seen that this increase in age is proportional with the increase in performance until a certain age, then performance begins to decline.

2 LITERATURE REVIEW

In the first article I read titled "Increase in the Age of Olympic Swimmers in Modern Times" written by Mazzilli, discusses how studies have shown an increase in age for women in long distance races and an increase in men for short distance races entering the Olympic games for swimming.

In the second article titled "The determinants of performance in master swimmers: an analysis of master world records" written by Zamparo, discusses the age that swimmer's peak performance is maintained until. Zamparo says this age is around 35-40 years old.

In the third article titled "The changes in age of peak swim speed for elite male and female Swiss freestyle swimmers between 1994 and 2012" written by Christoph Alexander Rust, discusses the "changes in the age of peak freestyle swimming performance

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from 50 to 1,500 m for both elite female and male swimmers over time in recent years". He reveals that women hit their peaks much earlier than men. This is shown later in a graph towards the end of this paper. Rust results were remarkable. His findings showed that "age was positively associated with swimming speed for 50 - 800 m freestyle, but negatively for the 1,500 m freestyle. This suggests that athletes would be faster at higher ages with the exception of the 1,500 m freestyle." (Rust, pg. 7). These findings lead one to ask the question, will an increase in age cause a swimmer to perform better?

2.1 Methods

The data I gathered came entirely from Wikipedia. I found a Wikipedia page that displays the world record progression for each event. Because I am solely focused on speed, I only collected data for 50m events. This means that I collected data for the 50m freestyle, 50m breaststroke, 50m backstroke, and 50m butterfly. After reading through my article I realized that the peak performance is different for both men and women, so I decided to collect data for both genders. It was a difficult and tedious process to gather the data the way I desired. I first copied and pasted each data table from Wikipedia to an empty excel sheet. Then I added columns of my own such as: Gender, Date, Stroke, and Age. This was a very tedious process because I had to manually enter data for 128 rows 4 times. Five out of the ten rows in the data table were utilized to create the graphs needed to prove my claim true. However, I will describe each column anyway so that you as the reader have a better understanding of the data¹. **Table 1**

#	Time	Gender	Name	Nationality	Date	Meet	Location	Stroke	Age
0	1 23.98	Male	Jonty Skinner	South Africa	1976	AAU Nationals	Philadelphia, PA, United States	Freestyle	22.0
1	2 23.74	Male	Joe Bottom	United States	1977	Canada Cup	Etobicoke, Canada	Freestyle	22.0
2	3 23.72	Male	Ron Manganello	United States	1978	-	Miami, FL, United States	Freestyle	NaN
3	4 23.70	Male	Klaus Steinbach	West Germany	1979	-	Freiburg, West Germany	Freestyle	26.0
4	5 23.68	Male	Chris Cavanaugh	United States	1980	International Invitational	Amersfoort, Netherlands	Freestyle	18.0
5	6 23.12	Male	Chris Cavanaugh	United States	1980	USA Spring Nationals	Austin, TX, United States	Freestyle	18.0
6	7 22.96	Male	Rowdy Gaines	United States	1980	USA Spring Nationals	Austin, TX, United States	Freestyle	21.0
7	8 22.83	Male	Bruce Stahl	United States	1980	USA Spring Nationals	Austin, TX, United States	Freestyle	NaN
8	8 22.83	Male	Joe Bottom	United States	1980	Hawaiian Invitational	Honolulu, HI, United States	Freestyle	25.0
9	9 22.71	Male	Joe Bottom	United States	1980	Hawaiian Invitational	Honolulu, HI, United States	Freestyle	25.0
...
118	9 28.09	Female	Li Yang	China	2007	World Military Games	Hyderabad, India	Backstroke	NaN
119	10 28.00	Female	Hayley McGregory	United States	2008	Texas Senior Circuit Championships	Austin, United States	Backstroke	22.0
120	11 27.95	Female	Emily Seebohm	Australia	2008	Australia Championships	Sydney, Australia	Backstroke	16.0
121	12 27.67	Female	Sophie Edington	Australia	2008	Australia Championships	Sydney, Australia	Backstroke	24.0
122	12 27.67	Female	Zhao Jing	China	2009	China Championships	Shaoxing, China	Backstroke	19.0
123	13 27.61	Female	Daniela Samulski	Germany	2009	Germany Championships	Berlin, Germany	Backstroke	25.0
124	14 27.39	Female	Daniela Samulski	Germany	2009	World Championships	Rome, Italy	Backstroke	25.0
125	15 27.38	Female	Anastasia Zuyeva	Russia	2009	World Championships	Rome, Italy	Backstroke	19.0
126	16 27.08	Female	Zhao Jing	China	2009	World Championships	Rome, Italy	Backstroke	19.0
127	17 26.98	Female	Liu Xiang	China	2018	Asian Games	Jakarta, Indonesia	Backstroke	22.0

Column one "#" lists the order of each world record ever set for swimming in a particular event. Column two "Time" lists the Swimmers' world record time for that race. Column three "Gender" was added to the initial data table so I could show the comparison between both genders. Column four "Name" list the athletes' name. Column five "Nationality" list the nationality of each swimmer but, was not useful in this project. Column six "Date" was adjusted so I could show the Increase in speed each year of these athletes. Column seven "Meet" list the name of the meet that the record was set at but, is not useful for this project. Column eight "Location" list the location of where the race took place but, is not useful in this

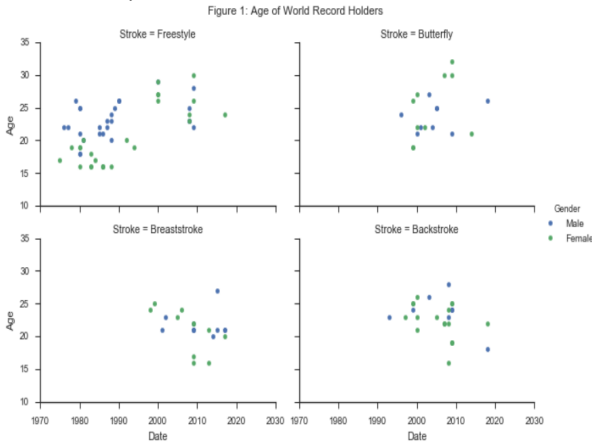
¹https://en.wikipedia.org/wiki/World_record_progression_50metresfreestyle

project. Column nine "Stroke" was added to show the difference in peak performance for each stroke. Finally, column ten "Age" was added in order to show the increase in age of swimmers competing in the Olympics.

2.2 Results

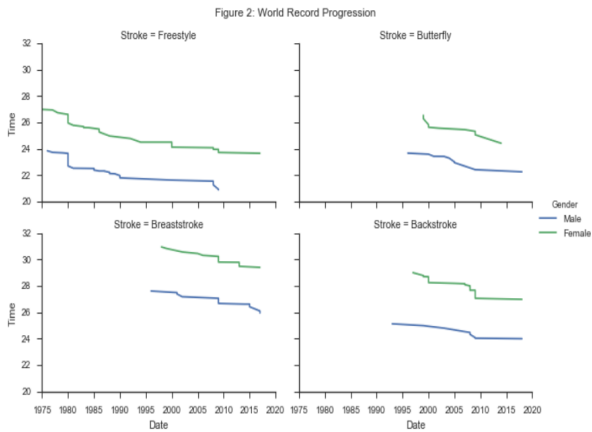
I gathered and manipulated data to show the relationship that age has on a swimmers' performance. First I created a scatter plot displaying the Age vs Date using the data I collected. Next I built a graph that presents the increase in time of these swimmers. Lastly, I constructed a chart that shows the difference in speed as swimmers age.

2.2.1 Age vs Date. **Fig. 1** I took the data I found and plotted an age vs date scatter plot that shows the age of each athlete at the specific date they broke a world record for 50m events.



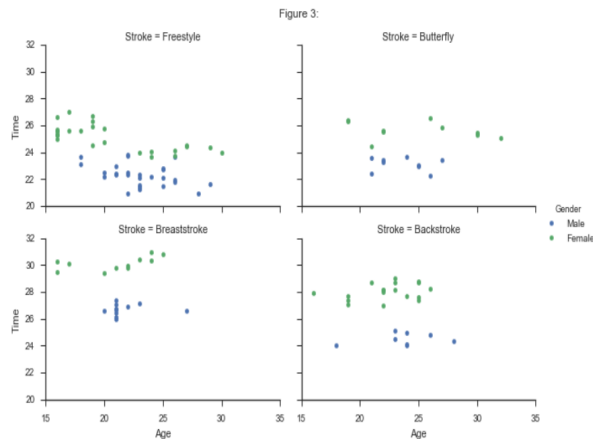
The purpose of this graph is to show that the fastest Olympian swimmers are increasing in age every year. This graph proves that the top male and female freestyle sprinters have increased in age over the years.

2.2.2 Time vs Date. **Fig. 2** I took the same data and plotted a time vs date line graph. This shows the rate at which the world record progression for 50m events is increasing.



This diagram shows that the rate at which these athletes have increased in speed since the first world record was set.

2.2.3 Time vs Age. Fig. 3 I took the data I collected and plotted a time vs age graph.



This graph shows that freestyle is the only 50m stroke that has increased in speed as the swimmer ages.

2.3 Discussion

Overall, the results of this research propose that the increase in age of Olympian swimmers is causing an increase in speed of these athletes. The results from figure 1 present this growth. These results show that the top swimmers, particularly in freestyle, are currently out performing swimmers in the 1900's at an older age. Research "showed in 2013 that the mean age of male swimmers was 21.1 years in 1984 but 25.8 in 2012, whereas the corresponding ages in women went from 18.9 to 21.6 years." (Mazzilli). Scientists have discovered that swimmers are faster at an older age due to their ability to perform closer to their peak performance. The results from figure 2 prove that contrary to common belief, short distance swimmers do not reach their max potential until the age of "30 to 39" (Rust, pg. 2). The results from figure 3 are crucial because they show that the swimmer receives the greatest benefit in the 50m freestyle at an older age. These results are valuable because they suggests that a swimmer should continue their professional career until they hit their peak performance.

2.4 Conclusion

To summarize, there has been an increase in the age of Olympian swimmers over the years of the sport. However, this increase in age has caused short distance swimmers to improve their times. Studies have shown that the reason these athletes are able to improve their times is because swimming has a higher peak performance age than most sports do. It is critical that this information be shared amongst the swim community because this could potentially contribute to more competition in the sport which will lead to an increase in swimmers speed. After swimming for 16 years myself, I was constantly told that I needed to continue to push myself because I only had a few more years to reach my maximum potential. I was 18 years old the last time I had a coach tell me that. I am currently 20 years old, had I known that the age at which a short distance swimmer reaches his or her peak performance were at such an old age I would never have ended my swim career. The product of this

study produces an important decision for modern day swimmers. They must decide if its worth it to continue to train at such a high intensity for 10+ years in order to reach their max potential.

A HEADINGS IN APPENDICES

Here is an outline of the body of this document in Appendix-appropriate form:

A.1 Introduction

A.2 Literature Review

A.2.1 Methods.

A.2.2 Results.

Age vs Date.

Time vs Date.

Time vs Age.

B DISCUSSION

B.1 Conclusion

B.2 References

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