Deterioration of Skill in Competitive Archery Due to Age

An examination of high-level male recurve archers

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1 ABSTRACT

This paper focuses on how age impacts the performance of high-level male recurve archers. The primary focus of this examination is to compare the performance of young and old archers to see how they compare to one another. For this study, the current 199 top-level archers in the world were selected and examined. The participants' age range was 16-50, with the average age of an archer being 25.14. It was found that archers of ages 16-32 years of age average an increase in performance as they age, while archers older than 32 suffer a decrease in performance as they age. This leads to the conclusion that age has a high impact in the world of archery.

1.1 KEY WORDS

Archery, Age, Skill, Male, Deterioration, Performance, Recurve

2 INTRODUCTION

In most competitive sports there exists an age at which the athlete's performance will start to decline as they get older [1]. This research has been conducted for many of the more popular sports, however, there is not much research that has been published about this topic in recurve archery. The research below examines the effects of age on the performance of professional male recurve archers.

2.1 RESEARCH PROCEDURE

The data was found on www.Worldarchery.org [2], a group committed to the world of archery. The relevant statistics of each archer were extracted, and through a data wrangling process described in section 4.1, organized and compiled in a Jupyter Notebook for inferences and calculations.

2.2 RESEARCH RESULTS

This research suggests that while age is not a definitive determinant of the skill of an archer, the trends and patterns suggest that age does influence the performance of an archer when competing. There are many factors that can influence their performance. Age [1], Stress control [6], anxiety [3], heart rate patterns [5][9], and length of training all factor in and can be attributed to age. The research has found that archers steadily increase their performance as they age up to the age of 32, after which their performance drops off dramatically when competing at the highest level of the sport.

2.3 RESEARCH IMPORTANCE

This research can be used to examine the performance of archers based on their age. It can also offer answers to some questions that resulted when reading relevant literature.

3 LITERATURE REVIEW

In the following subsections, literature from relevant research will be examined, and several questions will be formulated to discuss in the discussion section of the paper.

3.1 HOW FAST DO WE AGE?

The first piece of literature, "How Fast Do We Age? Exercise Performance Over Time as a Biomarker" [1] examined at which age the human body starts to perform worse in physical activities, and at what rate. The results suggest that athletes generally start to perform worse after the age of 34, with a decrease rate of 0.5% in performance for each year over 34.

3.2 PSYCHOLOGICAL SKILLS OF ELITE ARCHERY ATHLETES

The article "Psychological skills of elite archery athletes" [3] examined psychological factors such as anxiety and stress and how they influence the performance of the athletes. The study found that archers who were 28 and older were better able to deal with stress and anxiety, compared to archers who are younger than 28.

3.3 PREVELANCE OF SHOULDER PAIN IN COMPETETIVE ARCHERY

The research provided by the article "Prevalence of Shoulder Pain in Competitive Archery" [4] examined if the overuse of the same group of muscles in archers causes chronic shoulder pain. It has discovered that in groups of athletes of ages 15 to 28, 54.4% of archers suffer from this condition, and that competitors of ages 20 and up are much more likely to suffer from it.

3.4 AGE DIFFERENCES IN HEART RATE PATTERNS DURING CONCENTRATION IN A PRECISION SPORT

The scholarly article titled "Age Differences in Heart Rate Patterns During Concentration in a Precision Sport: Implications for Attentional Functioning" [5] recorded heart rate patterns for varying age groups when competing in precision sports. The researchers have found that younger participants, of an average age of 29.5 were more in control of their heart patterns as they competed in the sport, compared to their older counterparts of an average age of 50.

3.5 EFFECTS OF ADULT AGE AND LEVEL OF SKILL ON THE ABILITY TO COPE WITH HIGH-STRESS CONDITIONS IN A PRECISION SPORT

The article "Effects of adult age and level of skill on the ability to cope with high-stress conditions in a precision sport" [6] tested their participants on how well they were able to focus in precision sports. It was found athletes who were, on average, 25.5 years old were able to stay more focused than their older counterparts of an average age of 50.7.

3.6 EFFECTS ON ARCHERY PERFORMANCE OF MANIPULATING METAMOTIVATIONAL STATE AND FELT AROUSAL

The article "Effects on Archery Performance of Manipulating Metamotivational State and Felt Arousal" [8] examined if archers had an increase or decrease of performance based on their felt arousal level. This research concluded that there is a difference between high and low levels of arousal, but the difference is not big enough to be statistically significant.

3.7 A STUDY OF THE RELATIONSHIP BETWEEN HEART RATE VARIABILITY AND ARCHERY PERFORMANCE

Another study on heartbeat patterns in archers titled "A study of the relationship between heart rate variability and archery performance" [9]. This study has found that steady heartbeat patterns led to a better performance in archery, which agrees with the findings of section 3.4

3.8 PROVISION OF SPORT PSYCHOLOGY SERVICES TO TAIWAN ARCHERY TEAM FOR THE 2004 ATHENS OLYMPIC GAMES

The article "Provision of sport psychology services to Taiwan archery team for the 2004 Athens Olympic Games" examined if providing psychological training along with physical training had an improvement on the performances of archers. It has found that the archers had a significant improvement in performance after this change.

3.9 SKILL PERFORMANCE ON BIORHYTHM THEORY'S PHYSICALLY CRITICAL DAY

The study "Skill Performance on Biorhythm Theory's Physically Critical Day" examines if the biorhythm theory could have any influence on the performance of the archers on a given day. It has found no evidence that archers are affected by this theory.

3.10 EFFECT OF SENSORY MOTOR RHYTHM NEUROFEEDBACK ON PSYCHO PHYSIOLOGICAL, ELECTRO-ENCEPHALOGRAPHIC MEASURES AND PERFORMANCE OF ARCHERY PLAYERS

The study mentioned above measured the effect of training in heart race deceleration, arousal levels and other metrics had on the performance of archers. It has suggested that neurofeedback training in those skills improves archery performance.

3.11 RESEARCH QUESTIONS

Question 1: Since the general athlete declining age begins at 35[1], can the same age of decline be observed in archery, or does it differ?

Question 2: Since there seem to be many factors such as age [1], stress control [6], anxiety [3], heart rate patterns [5][9], and length of training that can affect how an archer will perform, is there an optimal age for managing these factors and improving performance?

Question 3: If question 2 can be determined, can these results can be seen in the real-world dataset we are using?

The following subsections detail the collection of the data and the wrangling process, with the results presented in section 5.

4 METHODS

The process of data extraction and analysis is detailed below, followed by explanations for how the data was divided in order to answer research questions the most effectively.

4.1 DATA COLLECTION

The dataset used in this paper consists of 199 of the current top male recurve archers. The data had to be updated and recollected since the last project due to a recent archery competition which changed the rankings of the players. The current rankings can be found at www.worldarchery.org/world-ranking [2]. The names, ranking, and score of the archers were copied into word processing software and altered into a csv format using the find and replace function. Age and average arrow score had to be manually added to the dataset by hand as those needed to be extracted from each archer's profile individually. Originally there were 200 archers in this list, but one individual had to be removed because their age was not listed. Since this paper heavily relies on the age of this archer, the data of this archer was of no use and therefore removed.

4.1.1 Data Column Details

- World Rank – Current ranking, lower rank is better

- Name – The archer's full name

- Score – Average points of the last 4 competitions

- Age – How old the archer is

- Average Arrow – Career average arrow score as defined by the F.I.T.A scoring standards [7]. – Reference

4.2 DATA ORGANIZATION AND PRESENATATION[1]

The data was then organized into different age groups in order to more effectively answer the research questions that have been asked in section 3.6. The subsections below detail how the data has been organized for each question.

Age	# of Archers	Cumulative Amount	Cumulative %
16	1	1	0.5
17	6	7	3.52
18	12	19	9.55
19	9	28	14.07
20	9	37	18.59
21	17	54	27.14
22	24	78	39.2
23	21	99	49.75
24	12	111	55.78
25	13	124	62.31
26	13	137	68.84
27	13	150	75.38
28	7	157	78.89
29	5	162	81.41
30	6	168	84.42
31	4	172	86.43
32	5	177	88.94
33	2	179	89.95
34	4	183	91.96
35	2	185	92.96
36	1	186	93.47
37	4	190	95.48
38	1	191	95.98
39	1	192	96.48
40	1	193	96.98
42	2	195	97.99
43	1	196	98.49
46	1	197	98.99
47	1	198	99.5
50	1	199	100

Figure 1: Table representation of the current 199 best male recurve archers
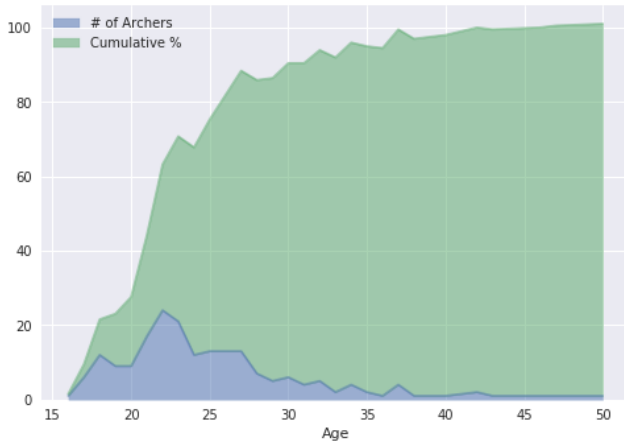

Figure 1.1: Graphical representation of the current 199 best male recurve archers.

4.2.1 Research Question 1

The first question that resulted from research asked when athletes start to have a decrease in performance. The study conducted found that athletes start performing worse at age 35 and over [1]. Our dataset suggests, however, that this decline in performance can be observed as early as age 33. Therefore, the dataset was divided into two age groups. The first group is aged 16-32, and the second 33+. The findings are represented below.
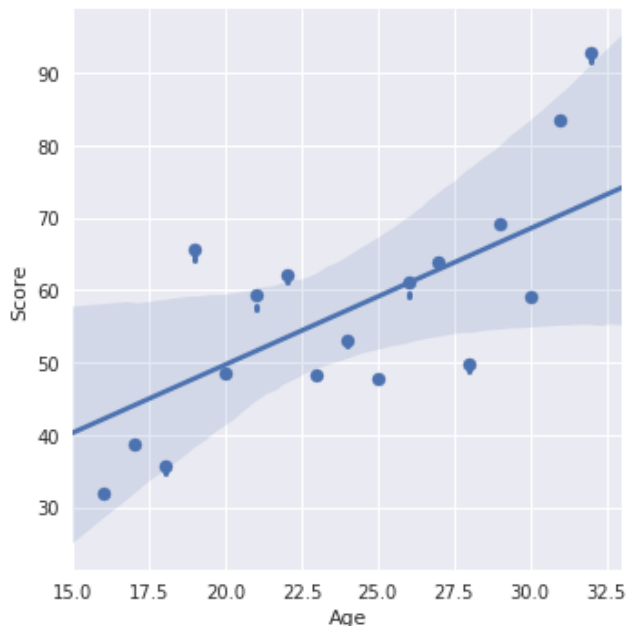

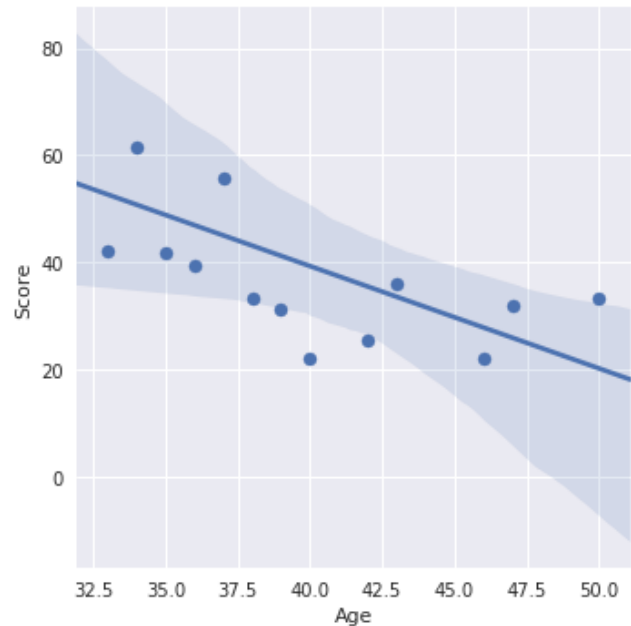**Figure 2.1: graphical representation of the average performance of archers aged 16-32**

Figure 2.2: graphical representation of the average performance of archers aged 33+

4.2.2 Research Question 2

The second question asked whether there is a mix of factors that tend to lead to the best performance of archers. For this, it is important to see the influence each factor has on the performance of the archers individually. The issues that were examined were anxiety, stress control, and heartbeat control. The studies found that the best age groups to handle anxiety were aged 28+ [3]. The stress control study found that individuals aged around 25.5 were better able to control their stress levels compared to older individuals of around 50.7[6]. A similar study found that heart rate control was better in participants with an average age of 29.5 compared to those who were averagely aged 50 [5]. As a result, the age groups were divided into two groups to see if a performance difference could be observed between the two. The first group consisted of ages 17-27, while the second group consisted of individuals aged 28-50. Heart rate and stress control examinations were combined into the same age bracket since they both examined very similar age groups. This ended up including age groups 20-30 and 40-50, close to the age groups tested in the studies.
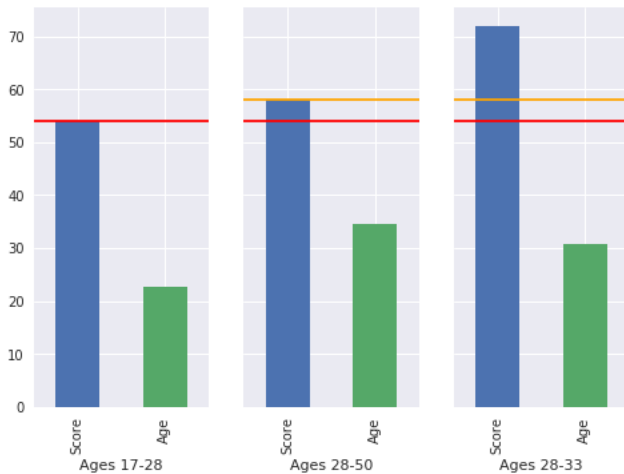
Figure 3.1: Comparison of age groups 17-27, 28-50 and 28-33 in terms of average score and age, used for anxiety control analysis. Graph 28-33 takes into account findings from question 1 which stated best performance happens under 34.
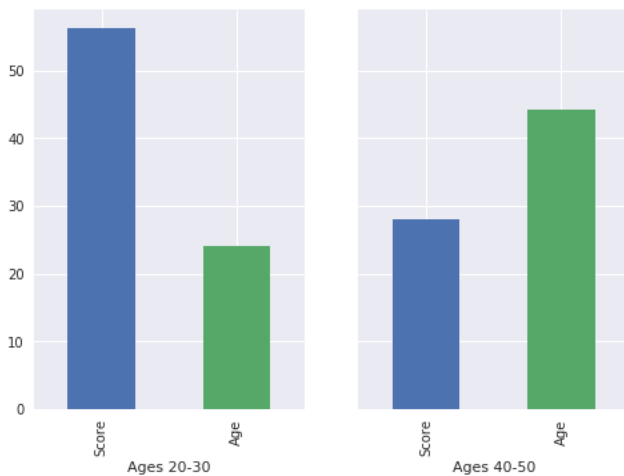

Figure 3.2: Comparison of age groups 20-30 and 40-50 in terms of average score and age, used for heart rate and stress control analysis.

5 RESULTS

Our archer analysis has found that 150 of the 199 best archers in the world are of age 26 and under, as shown by figure 1. While this is the most numerous group, it is not the group with the best performance. Archer performance is influenced by factors such as age [1], stress control [6], anxiety [3], heart rate patterns [5][9], and length of training, which are influenced by the archer's age.

Research has found that athletes tend to perform worse starting at age 35 [1], but our dataset suggest this can be seen as early as age 33. This is best demonstrated by figures 2.1 and 2.2, which show the performance increases and decreases of each age group. As demonstrated, the performance of archers tends to increase as they age, up to the age of 33, after which their performance will drop.

Anxiety was found to be best controlled by individuals aged 28 and over, and the results can be seen in figure 3.1. Figure 3.1 also showcases the findings of figure 2.1 and 2.2, which shows the gradual general improvement of the average performance of archers up to the age of 33.

Heart rate and stress control were found to be better controlled by archers who were 20-30 than those who were 40-50[5][6]. Analysis done on our dataset has found that archers who are 20-30 do perform better than those who are aged 40-50, as shown by figure 3.2.

Combining all these factors, it has been found that archers who perform the best are generally aged 28-33, as seen in figure 3.1 This is most likely due to a mix of the aforementioned factors, although it cannot be found which factor has the biggest influence on the matter.

6 DISCUSSION

The found results suggest that age influences how well competitive archers do. In the literature review section, a few questions were raised in regard to tying in the research done to this real-world dataset. These can now be answered below.

6.1 DISCUSSION OF QUESTION 1

Our first question "Since the general athlete declining age begins at 35[1], can the same age of decline be observed in archery, or does it differ?". The dataset used suggests that this performance decrease actually can be seen at age 33 and up. Figures 2.1 and 2.2 show a significant drop off in terms of performance starting at age 33, after which it never recovers and follows a downward trend.

It can also be observed that performance can be seen dropping well below the 30-score mark, as shown by figure 2.2, performing even worse than the youngest archers as shown by figure 2.1. This shows that the performance decrease of these archers is severe, and age has a big impact on their world rankings.

It is important to note that that the sample size of archers aged 33+ is also very small consisting of just about 10% of the total dataset as shown in figure 1. This further suggests that as archers age past 33, they do not compete at the highest

level of the sport anymore, which explains why so few are found in our dataset.

6.2 DISCUSSION OF QUESTION 2 AND 3

Our second question explored "Since there seem to be many factors such as age [1], stress control [6], anxiety [3], heart rate patterns [5][9], and length of training that can affect how an archer will perform, an optimal age for managing these factors and improving performance?" and the third question asked whether the "results can be seen in the real-world dataset we are using". In order to avoid repeating the same information, these questions will be answered one after another.

Research done suggests that there are optimal ages for archers to control each of these factors, each with a different age group.

Research suggests that archers who are aged 28+ tend to have better anxiety control compared to those aged 17-27 [3]. I was able to confirm the better performance of archers aged 28+, as shown in figure 3.1, however I was not able to confirm whether this is due to anxiety control or other factors such as longer training.

Research also suggests that archers who are between 20-30 have better heart rate and stress management skills than those who are of ages 40-50 [5][6]. Again, I was able to confirm the correlation of performance of archers aged 20-30, but not able to pinpoint the exact causation.

While I could examine the performance of these archers based on their scores, it is impossible to pinpoint how much each factor influences each archer's performance. This suggest better performance comes from longer training, and a mix of learned techniques done in order to manage the beforementioned factors. This appears to only work until the age of 33, after which it would seem that the body is not able to handle managing these factors as well as it used to, even with longer training time.

Encompassing all this suggests that the best performing archers will be between the ages of 28 and 33, which is consistent with the results found from the real-world dataset.

7 CONCLUSIONS

The found results suggest that age is a significant factor on the performance of the best male recurve archers in the world. The dataset examined contained 199 of the world's best male recurve archers, with an average age of 25.14.

The results suggest that archers generally tend to improve as they age. It was found that a general trend of improved performance can be seen as the archer ages, up to the age of 33. After 33, however, their performance seems to decrease significantly.

Archers ranging from 16 to 50 were compared and it was found that the best performing archers fall in the middle of the age range. The ages with the best performance ranged from 28-33, due to a mix of factors. Age [1], stress control [6], anxiety [3], heart rate patterns [5][9], and length of training all can influence how well an archer can perform in a competition and all can be influenced by how old the archer is.

While it was not possible to establish which factor had the biggest influence on the performance of the archers, it would appear that until the age of 33, a mix of all of these factors play a role in how well the archer will perform, and as the archer ages and gains more training, they learn how to adapt to these factors.

As a result, it can be concluded that age is a significant factor when it comes to archery performance, as many of these factors can be attributed to age in one way or another as indicated by the research done.

REFERENCES

[1] Walter M. Bortz,; How Fast Do We Age? Exercise Performance Over Time as a Biomarker, *The Journals of Gerontology: Series A*, Volume 51A, Issue 5, 1 September 1996, Pages M223–M225, https://doi.org/10.1093/gerona/51A.5.M223

[2] Anon. World Ranking. Retrieved December 5, 2018 from https://worldarchery.org/world-ranking

[3] Evangelos Bebetsos. 2015. Psychological skills of elite archery athletes. *Journal of Human Sport and Exercise* 10, 2 (2015). DOI: http://dx.doi.org/10.14198/jhse.2015.102.09

[4] Kaur Grover J, Kumar Sinha A G. Prevalence of Shoulder Pain in Competitive Archery, Asian J Sports Med. 2017 ; 8(1):e40971. doi: 10.5812/asjsm.40971.

[5] Bo Molander, Lars Bäckman; Age Differences in Heart Rate Patterns During Concentration in a Precision Sport: Implications for Attentional Functioning, Journal of Gerontology, Volume 44, Issue 3, 1 May 1989, Pages P80–P87, https://doi.org/10.1093/geronj/44.3.P80

[6] Lars Bäckman and Bo Molander. 1986. Effects of adult age and level of skill on the ability to cope with high-stress conditions in a precision sport. Psychology and Aging 1, 4 (1986), 334–336. DOI:http://dx.doi.org/10.1037/0882-7974.1.4.334

[7] Anon. Target scoring. Retrieved December 5, 2018 from http://texasarchery.info/target-scoring

[8] J.H. Kerr, H. Yoshida, C. Hirata, K. Takai, and F. Yamazaki. 1997. Effects on Archery Performance of Manipulating Metamotivational State and Felt Arousal. Perceptual and Motor Skills 84, 3 (1997), 819–828. DOI:http://dx.doi.org/10.2466/pms.1997.84.3.819

[9] C.-T. Lo, S.-H. Huang, and T.-M. Hung. 2008. A study of the relationship between heart rate variability and archery performance. International Journal of Psychophysiology 69, 3 (2008), 276. DOI:http://dx.doi.org/10.1016/j.ijpsycho.2008.05.231

[10] Tsung-Min Hung, Tse-Chuan Lin, Chia-Ling Lee, and Ling-Chun Chen. 2008. Provision of sport psychology services to Taiwan archery team for the 2004 Athens Olympic Games. International Journal of Sport and Exercise Psychology 6, 3 (2008), 308–318. DOI:http://dx.doi.org/10.1080/1612197x.2008.9671875

[11] Kathleen M. Haywood. 1979. Skill Performance on Biorhythm Theorys Physically Critical Day. Perceptual and Motor Skills 48, 2 (1979), 373–374. DOI:http://dx.doi.org/10.2466/pms.1979.48.2.373

[12] Sathiyaseelan Ganesan, Maman Paul, Jaspalsingh Sandhu, and Joelvarghese Simon. 2012. Effect of sensory motor rhythm neurofeedback on psycho-physiological, electro-encephalographic measures and performance of archery players. Ibnosina Journal of Medicine and Biomedical Sciences 4, 2 (2012), 32. DOI:http://dx.doi.org/10.4103/1947-489x.210753