

TRIATHLON: BIOMECHANICALLY WHO IS FAVORED?

James C. Van Dyke, Peter McGrain, Robert Arnhold
Department of Physical Education
Texas Woman's University
Denton, Texas 76204

The triathlon is most frequently a combination swim, cycle, and run event with varying distances dependent on how severe a test the race organizers wish to make the event. The Hawaii Ironman Triathlon - the most famous of the triathlons - features a 2.4 mile swim, 112 mile bicycle ride, and 26.2 mile run. Most triathlons being staged today incorporate distances proportional to the distances of the three events in the Hawaiian Ironman contest.

PURPOSE

The present investigation was an attempt to determine the relative contribution of each stage to the total triathlon based on polynomial regression analysis.

METHODS

The procedure for determining a prediction equation involved polynomial regression analysis. An attempt was made to develop a trend equation for each event and for each sex based on American and world record performances in swimming, cycling, and running as of August, 1983. Initially, each set of data was tested for a linear trend using time in minutes as the dependent variable and distance in kilometers as the independent variable. If the second degree trend did not significantly add to the correlation coefficient between the variables, then the linear trend was used as a predictor. The procedure yielded six prediction equations. For each sex, the prediction equations were used to determine a table of recommended triathlon distances.

RESULTS

The prediction equations for both sexes and the three activities were all linear. Figures 1 through 6 illustrate the various linear equations. Correlation coefficients for the six equations ranged from .98 to 1.00. Under these circumstances it was concluded that the best fit for distance (km) vs. time (min) was linear for each activity and for both sexes. Histograms were constructed to illustrate the discrepancy between actual Hawaiian Ironman distances and predicted distances for the Hawaiian Ironman contest (Figures 7 through 12).

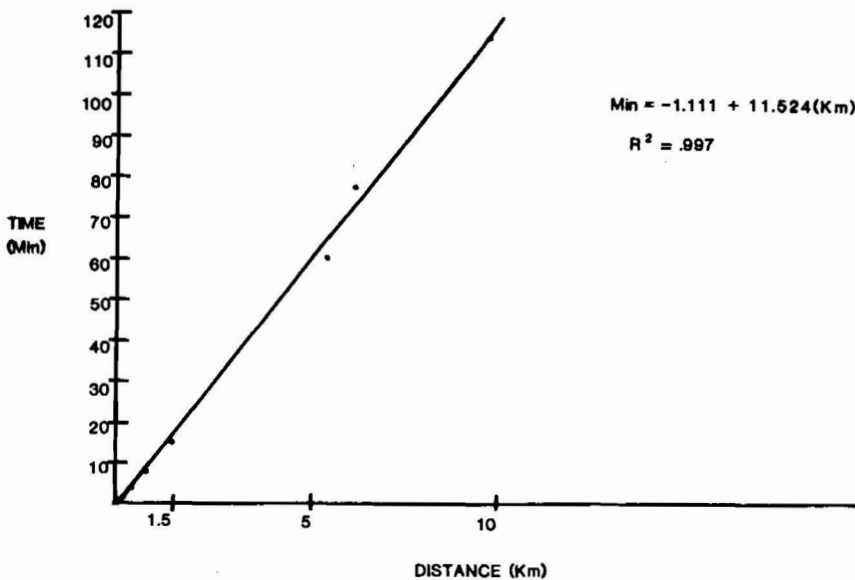


Figure 1 - Line of best fit for distance vs. time in men's swimming

(all times are reported from FINA or US Swimming, August, 1983).

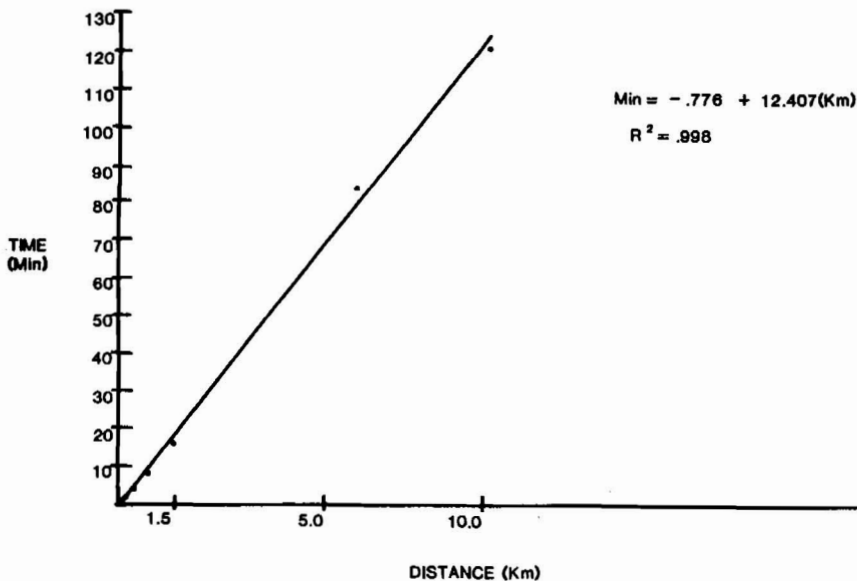


Figure 2 - Line of best fit for distance vs. time in women's swimming

(all times are reported from FINA or US Swimming, August, 1983).

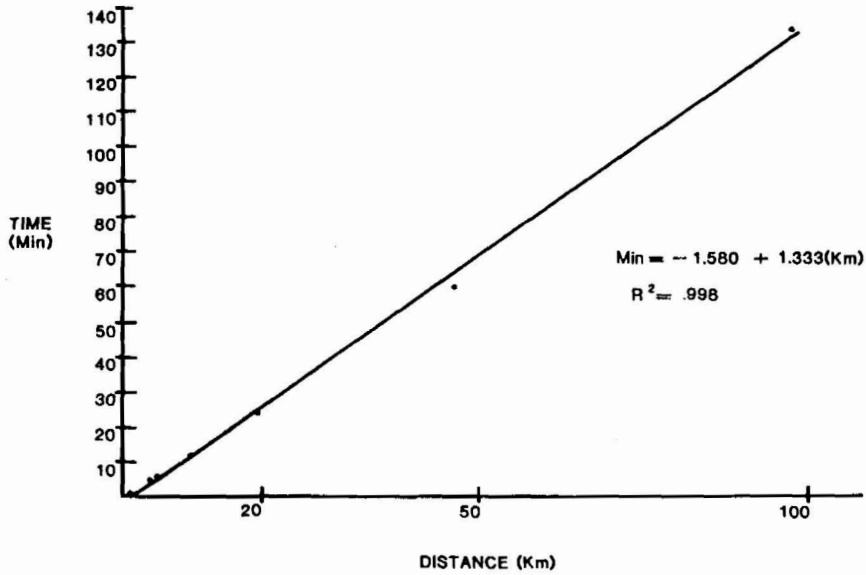


Figure 3 - Line of best fit for distance vs. time in men's cycling

(all times are reported from the United States Cycling Federation, 1983).

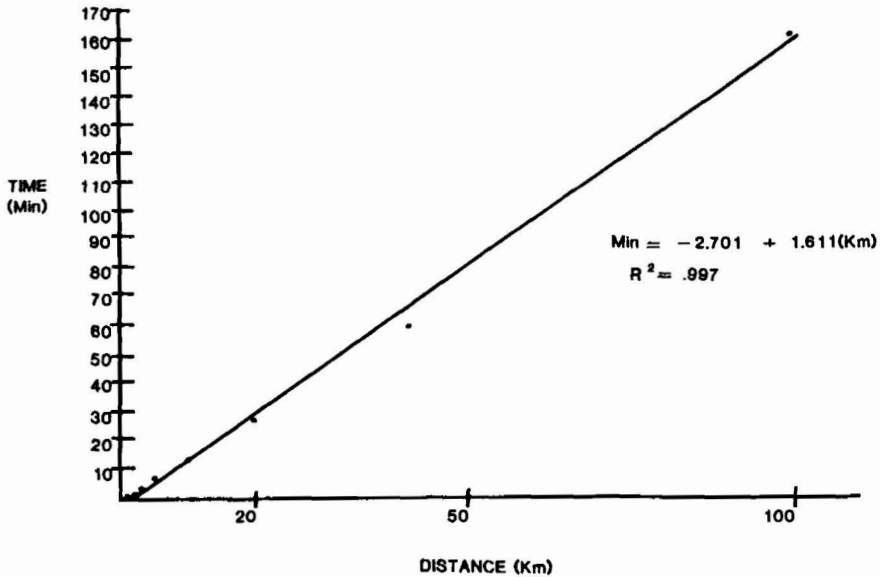


Figure 4 - Line of best fit for distance vs. time in women's cycling

(all times are reported from the United States Cycling Federation, 1983).

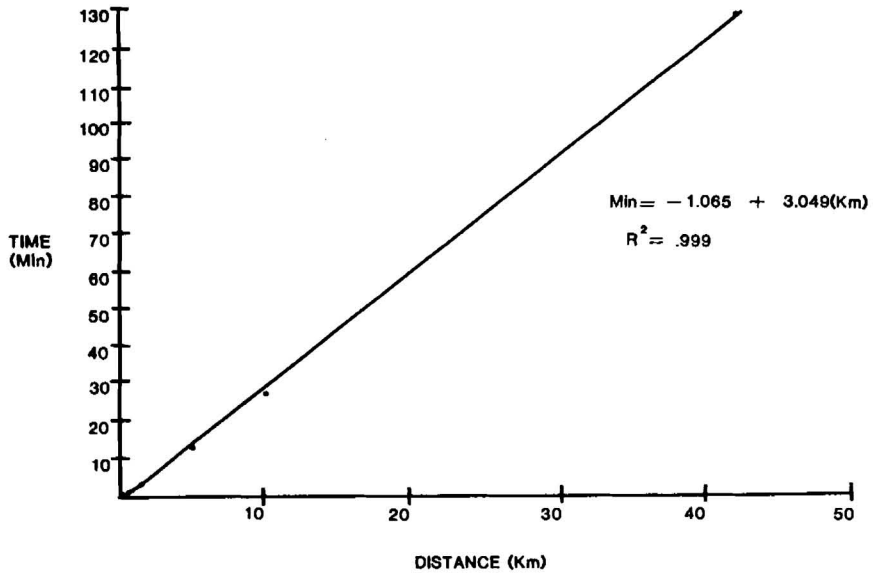


Figure 5 - Line of best fit for distance vs. time in men's running

(all times except marathon are reported from I.A.A.F. through July, 1983).

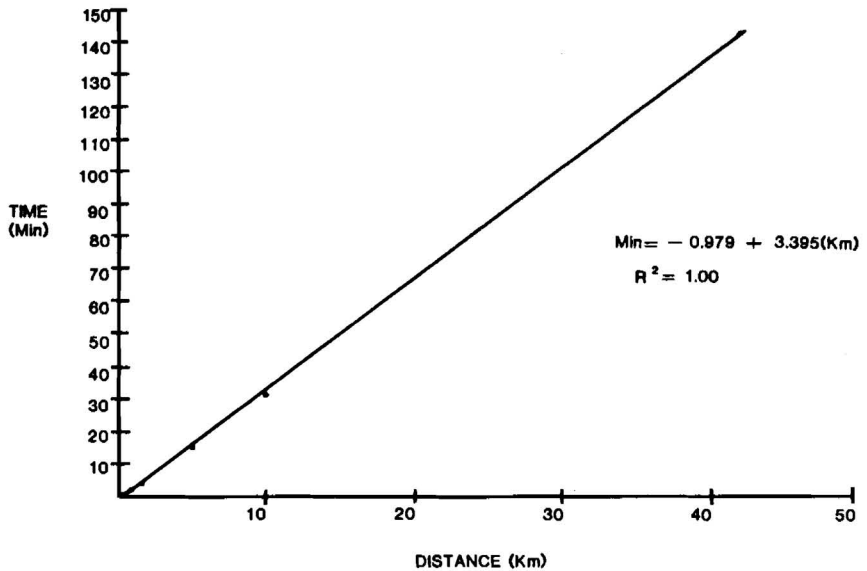


Figure 6 - Line of best fit for distance vs. time in women's running

(all times except marathon are reported from I.A.A.F. through July, 1983).

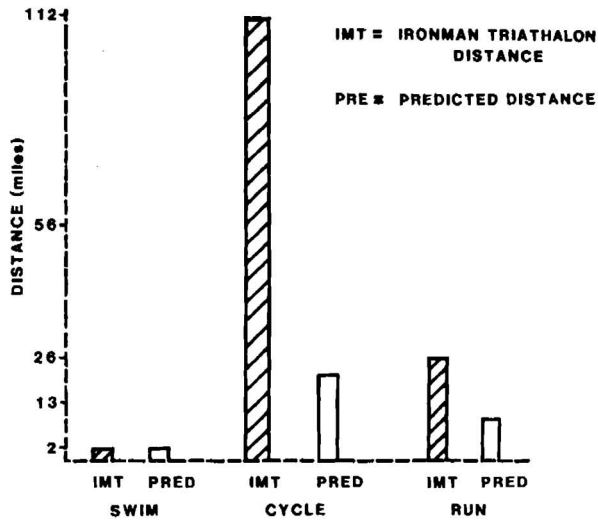


Figure 7- Comparison of the Ironman Triathlon distances vs. predicted distances for each event holding swim distance constant (males).

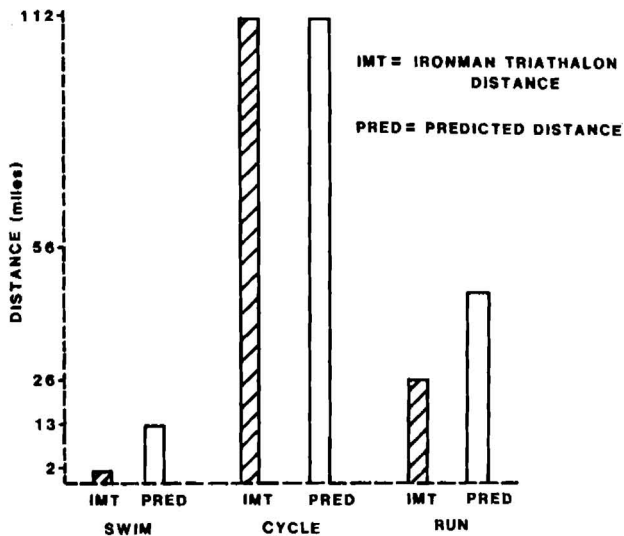


Figure 8- Comparison of the Ironman Triathlon distances vs. predicted distances for each event holding cycle distance constant (males).

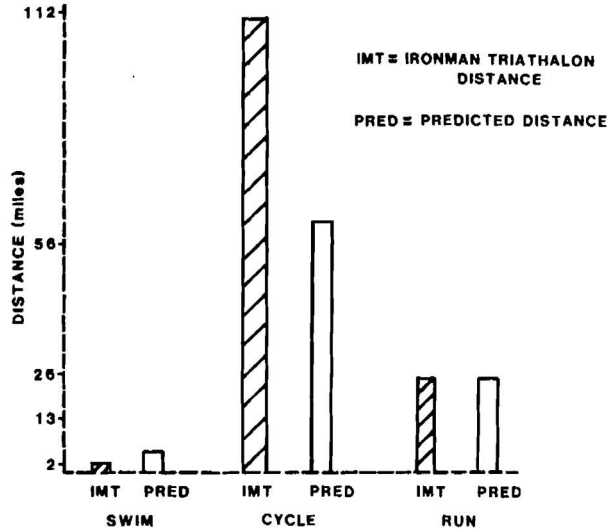


FIGURE 9- Comparison of the Ironman Triathlon distances vs. predicted distances for each event holding run distance constant (males).

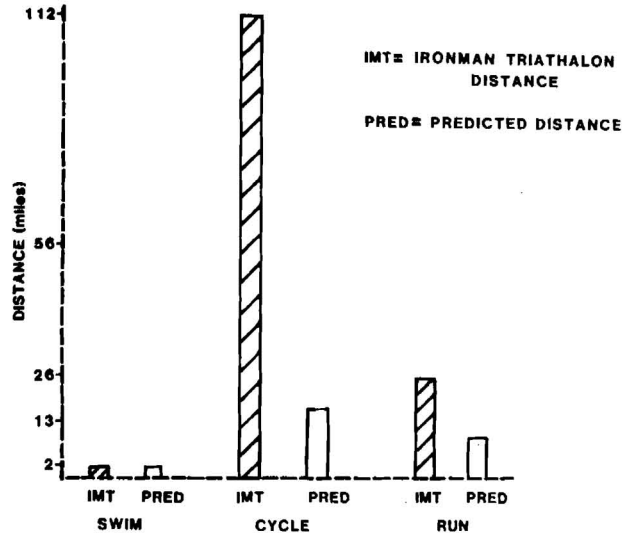


Figure 10 - Comparison of the Ironman Triathlon distances vs. predicted distances for each event holding swim distance constant (females).

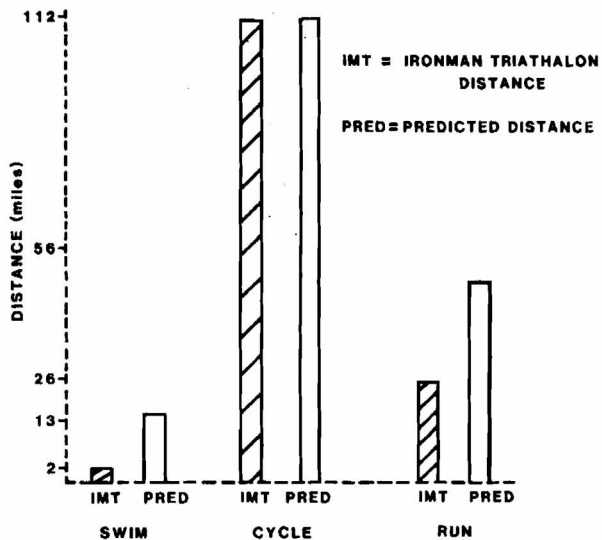


Figure 11- Comparison of the Ironman Triathlon distances vs. predicted distances for each event holding cycle distance constant (females).

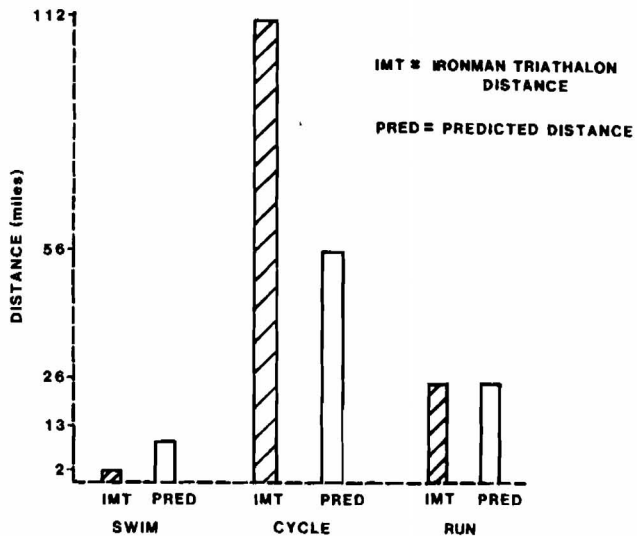


Figure 12 - Comparison of the Ironman Triathlon distances vs. predicted distances for each event holding run distance constant (females).

CONCLUSION

The use of polynomial regression to predict equitable distances for triathlons incorporating swim, cycle, and run stages demonstrates inherent unfairness in many of these contests. Based upon these findings, the Hawaiian Ironman Triathlon - and any triathlon with proportional distances - favors the cycling portion of the contest.

If a triathlon event is ever considered for future inclusion in the Olympic Games, a standardized, scientifically determined set of distances should be established. The polynomial regression technique, using data on elite performances in swimming, cycling, and running is a method that will determine equitable combinations of distances for triathlon events.

REFERENCES

- Henry, F.M. (1955). Prediction of world records in running (sixty yards to twenty-six miles). Research Quarterly, 26, 147-158.
- Lane, H. ed. (1983). The world almanac and book of facts
New York: Newspaper Enterprise Associates Inc.
- Lietzke, M.H. (1954). An analytical study of world and Olympic racing records. Science 119, 333-336.
- Masnoni, P., Lafortuna, C., Russo, G., and Minetti, A. (1982). An analysis of world records in three types of locomotion. European Journal of Applied Physiology, 49, 287-299.