

Should the fastest be the last? Strategic choice of athletes' order in relay races

Author: Nikolai Avkhimovich

Supervisor: Dmitry Dagaev

Abstract:

Athletes tend to choke in decisive moments (e.g. when a competitor is too close): the choking under pressure effect has been observed in different sports. Based on theoretical modelling and computer simulation of relay races, we will observe, whether coaches are able to manage choking factor through strategic choice of athletes' order and whether those changes could impact the probability of winning the relay race.

Extended abstract:

Considering that choking is rather widespread in sports and could lead to significant performance decrements, coaches might want to prevent or, at least, to minimize the negative effect from it.

In the paper we would like to focus on the strategic choice of coaches, when their athletes are under the choking effect. In particular, we would analyze the order of the athletes in relay races, which is determined by a team coach. Out of a lot of different types of relay races (running, cycling, biathlon, etc.) swimming might be a good illustrative example. Since focusing on strategic decision of a coach, it is important to avoid strategic choice of an athlete (for example, in running or cycling relays it could be beneficial for an athlete to be just behind the leader to avoid air resistance) as well as to minimize the effect of external factors (for example, baton passing and receiving skills in running or rifle shooting skills in biathlon). In swimming relays processes of passing each leg are the same, next swimmer is starting after touching the wall and each team have own swimming lane.

Looking at historical results of swimming relay races (Men and Women 4x100 and 4x200 freestyle relays) during the Summer Olympic Games from 2000 to 2021 as an example, we can observe, that in all cases average time of the final lap across leading teams is up to 4% lower than the average time of the first lap across those teams.

Are coaches following conventional wisdom on the athletes order ("fastest should be the last") or are there any strategies behind that decision? In the paper we would like to address the gap in research literature on athletes order choice in relays as coaches strategic decision, using theoretical modelling as well as computer simulations for more complex cases (e.g. different functional form of choking function and random realisation of choking value).

The paper is organized in the following manner. First, there is a general literature review on choking under pressure effect and relay races modelling. Next section introduces specific analytical framework of relay races under choking effect, as well as presents results of deterministic models without any choking effects and models with constant and parabolic choking function. At the end main insights are summarized, and key conclusions with possible future implications of the research are discussed.