Introduction

Observed Results Computer Analyzed

An Optimizing Time Correction Method For Yacht Racing

by

Jacob van Heeckeren

Compute the tightest grouping of corrected times.

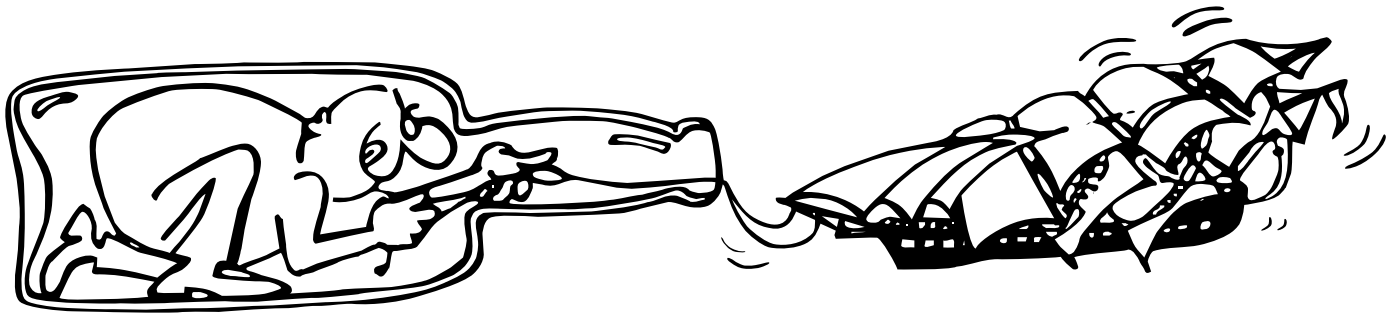
No subjective evaluation of actual race conditions required.

Scoring Committees cannot influence results.

Established and readily available ratings are used.

Calculations are based on elapsed times and ratings only.

Results are optimized in closed form.



Calculating optimized corrected times is no more difficult than putting a boat in a bottle. Once you find the right way to do it, it is really quite simple . . . . . with a computer, of course.

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What Does ORCA Do?

ORCA (Observed Results Computer Analyzed) provides the fairest corrected times for a race.

What Is Unique About ORCA?

The key to ORCA is the statistical optimization of the corrected times for the race. The buzzword used to describe this technique in today's technical parlance is *Fuzzy Logic*.

ORCA finds a length factor (L-Value) for each individual race. It then applies this common L-Value to the rating and elapsed time of each individual finisher to obtain a corrected time.

The optimized L-Value for the race is determined by statistically analyzing the elapsed times and ratings of the finishers. This is the only raw data required for the analysis. No other data is used. This is necessary and sufficient since the elapsed times of the finishers are the results of the conditions encountered on the race course, and the ratings represent (presumably fairly) their speed potential. (ORCA does not address the issue of rating fairness.)

Statistical analysis optimizes the L-Value to group the corrected times as tightly as possible.

Why Are ORCA Time Corrections Desirable?

They ensure the fairest racing.

Statistically speaking, over many races, and over many conditions, and over many different boats, the performance of the boats in a fleet can be described by a bell shaped curve. (Sort of like the picture in the children's book '*Le Petit Prince*' of the snake which swallowed the elephant).

A few boats do very well, a few boats do not do well at all, and most of the boats are spread about somewhere in between.

When finishing a fleet of boats, first there are a few boats which get there quickly, then an increasing stream of finishers develops, then for a while it gets real busy, then the finishing stream slows down again, and then the stragglers trickle in.

The bulk of the boats finished in the middle.

This is true for one design racing. It may not be intuitive that this is also true for handicap racing. However it is true when one considers the finishers as crossing the finishing line at their proper corrected times.

The middle group of finishers (on corrected time) sailed in the typical conditions which the bulk of the fleet encountered.

By optimizing the race results, ORCA groups the corrected times as closely as possible with emphasis on the middle part of the fleet, thereby making the racing as close as possible, and as fair as possible for the ratings in use.

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How Does ORCA Optimize A Race?

The computer program which executes the ORCA system encompasses quite a few pages of code. Through the use of high quality optimizing compilers and some specialized algorithms the actual execution times are quite acceptable.

ORCA's main optimizing algorithm evaluates a closed form expression directly. It does not make use of an incremental approximation. This is why the ORCA results are robust and the actual computation times remain reasonable.

ORCA uses a five stage optimization process. During each stage -- at each ORCA level -- the corrected times are optimized.

The optimization process includes evaluation of the statistical sample space to see if the sample is in fact statistically meaningful. Then it selects those corrected times which best represent the performance of the bulk of the fleet, and computes an optimized L-Value for that sample space.

During the progressive ORCA stages the sample space on which the optimization is performed is redefined to better represent the performance of the bulk of the fleet.

If during the testing for the validity of the sample space at a particular ORCA level it is determined that there is insufficient statistical merit to this sample space, then ORCA retreats to the previous ORCA level at which the sample space was statistically meaningful.

In the fully degenerate case where no statistical merit is found, ORCA retreats to time on distance. The only reason for entering a course length in the race description is to permit ORCA to retreat to time on distance.

On a few rare occasions ORCA does not proceed to ORCA level 5. This is usually the result of too few finishers, or exceedingly trying conditions on the race course.

Why Limit The ORCA Sample Space?

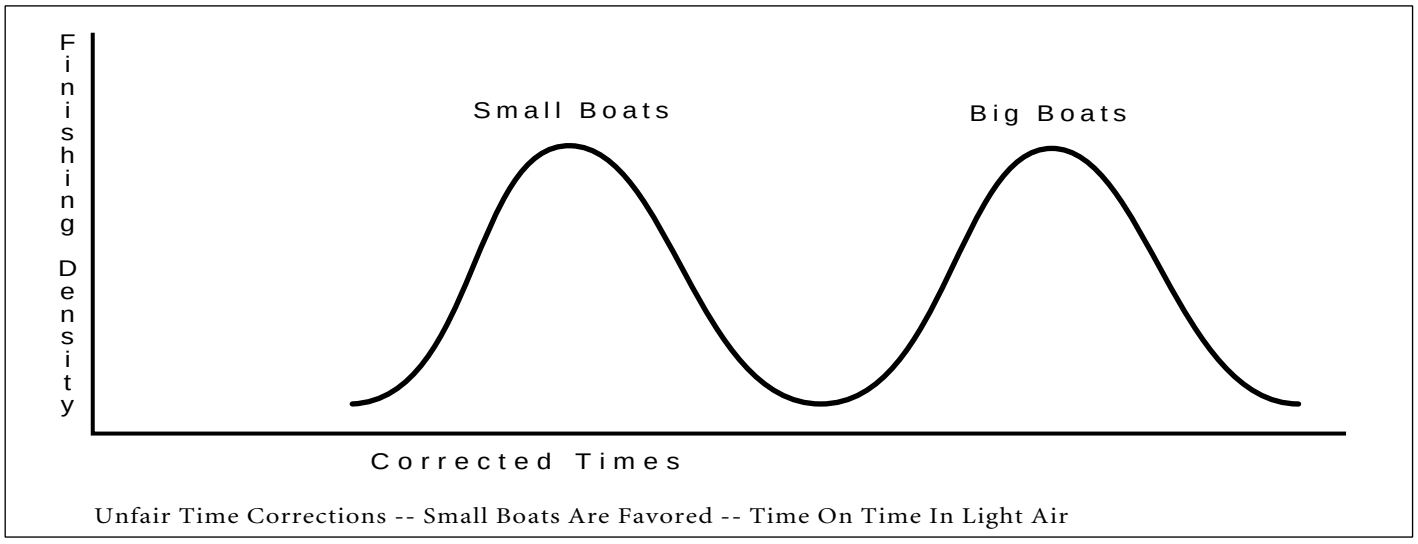
The few finishers who finished early, simply got away from the fleet. They sailed better than average. The few stragglers who are way back are exactly that, they just plain missed the connection. These two categories of finishers do not represent the conditions which the bulk of the fleet encountered. It is important to optimize over the bulk of the fleet, not the extremes.

One of the benefits happens to be for long ocean races where trophy dinners are frequently held before the last stragglers are in. Because ORCA does not include the stragglers in the final optimization process, the optimized L-Value for the race can be determined before the stragglers are in, and results can be posted which will not be altered by the stragglers.

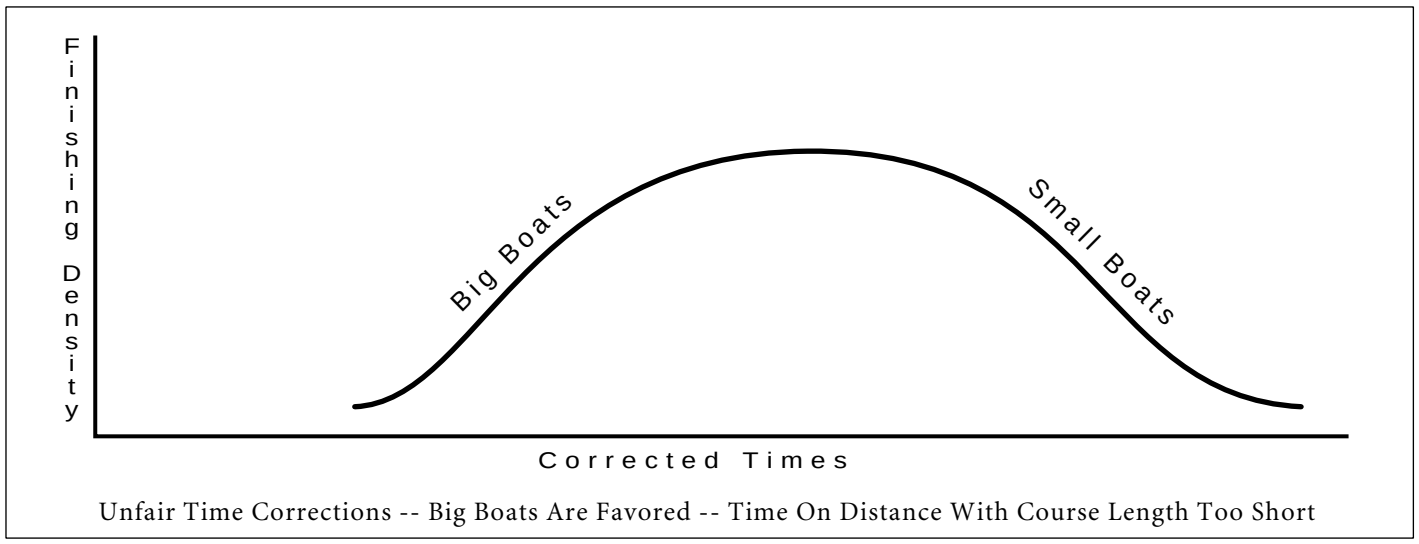
Of course, if a small boat is still out which could win, then her finish time may well later be included in the optimization process and change the corrected times of the fleet (although not necessarily - the fastest boats are also excluded by ORCA in the optimization process). In this case, however, it would take a rather brazen committee to award trophies before the eventual winner has even finished.

Is ORCA Optimization Practicable Without A Computer?

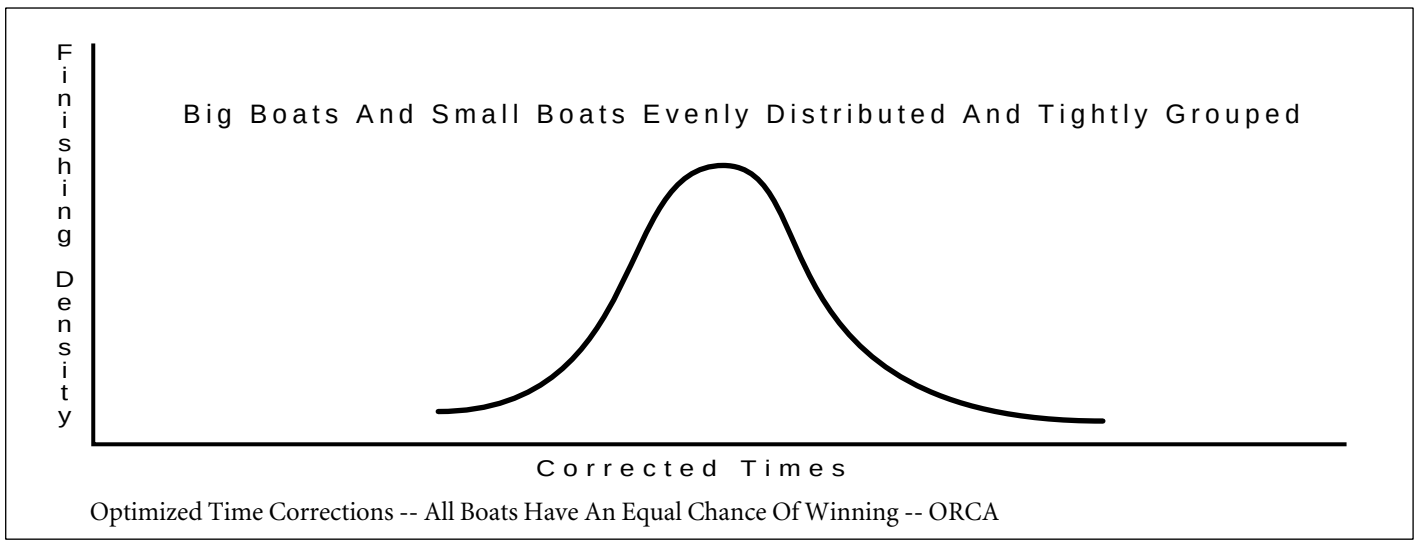
No.



Unfair Time Corrections -- Small Boats Are Favored -- Time On Time In Light Air



Unfair Time Corrections -- Big Boats Are Favored -- Time On Distance With Course Length Too Short



Optimized Time Corrections -- All Boats Have An Equal Chance Of Winning -- ORCA