

# How coaches could use the RP3 indoor rower to improve rowers and help crews to achieve their goals and ambitions.

*How training of the Forcecurve on RP3 could help and improve the performance of rowers and crews.*

by Stef Broenink & Stephan Bon, RP3 Rowing - Haaksbergen, The Netherlands,  
Version: June 2023 - 1.3

## Summary

As a coach, how can you really make a rower to row better and what data could support this? Many coaches and rowers (self-coaching) measure more and more. Speed, pace, rate and distances or segments. Training schedules prepare the rower and crew for the next goal, but how can data from the boat be used for improvement? And where is it useful and meaningful to accelerate the learning curve and improve the rower or crew technically?

This white paper is a document to understand the benefits of using the concept of a force curve, direct feedback, using numbers training on the RP3 indoor rower and how it is used more and more by high performance teams and international crews.

## Introduction

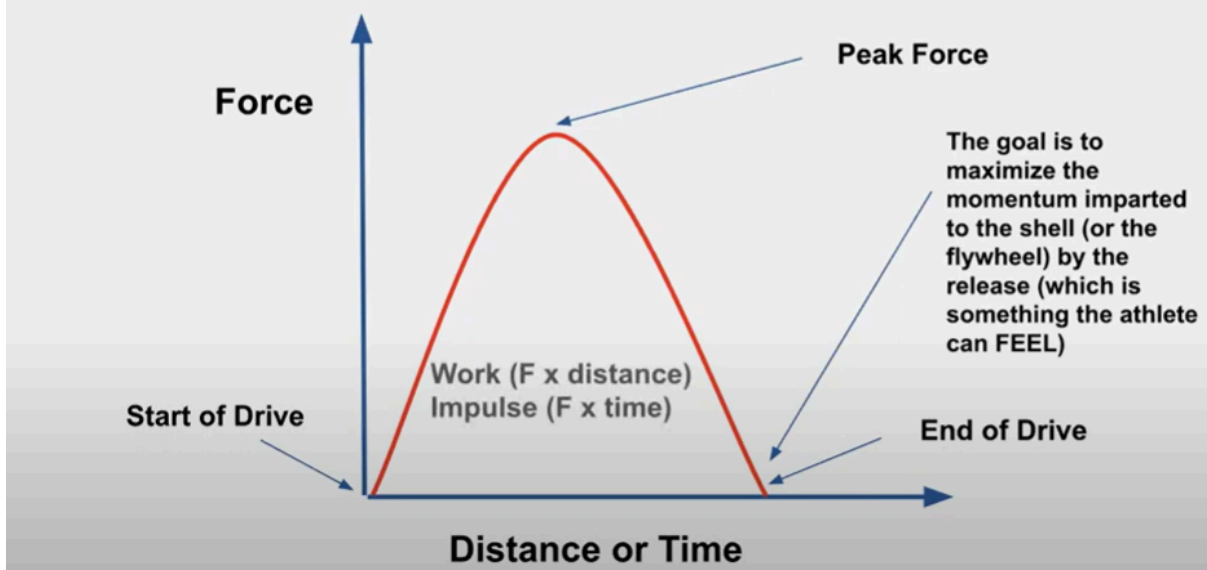
The force curve is formed by the start and end of the stroke (= the total stroke length), the time that pressure is applied. In the boat it is the pressure or force on the blade applied by the rower and on the ergometer - by the power of the rower - on gear of the flywheel.

*A rower's physical ability is often an indicator of potential performance in the boat. Coaches like to know, by measuring power - e.g. in a step test - how the training effort is progressing and the capacity of the rower. The rower's skills are the link between power delivery and applying force in the boat for acceleration and speed. Training intensity in coaching should work with power measurements and when focusing on boat speed you should work with force measurements.*

The power supplied by the rower is converted via a calculation to the Force Curve, both in the boat and on the ergometer. In the boat, the force (Newton) can be measured with special tools on the oars and/or the foot stretcher, where the measured force can be translated into the power (Watts) of the rower during a stroke (Joules) on the ergometer.

In addition, the height of the curve (peak force) and position of the highest point (peak force position), where the shape is created by the force development in the stroke: the line between these 3 points.

## What Is A Force Curve?



Source: coach Neil Bergenroth

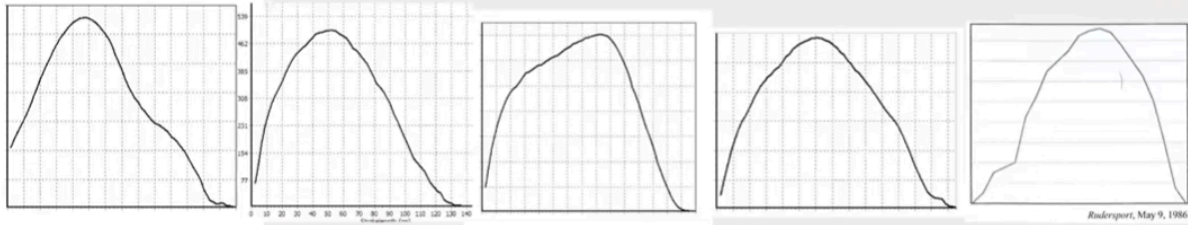
*“The Force Curve is a window into the effort of the force application during the drive phase”*

There are roughly two types of curves:

- **Kernschlag** stroke: “Solid Stroke with a hard beginning” - more front loaded force application curve. Rowers normally have a very sequential style (legs - back - arms)
- **Schubschlag** stroke: “Thrust stroke” - more symmetrical curve with progressive application of force from the entry, surging force application from beginning to end of the stroke

After many years of measuring and recording, first on RowPerfect - the predecessor of the current RP3 - of different (top) rowers since the 1980s, and now on RP3 of different curves in many crews, we can conclude that the “**Schubschlag**” curve produces the best result for high boatspeed and wins at races.

## Force Application Continuum



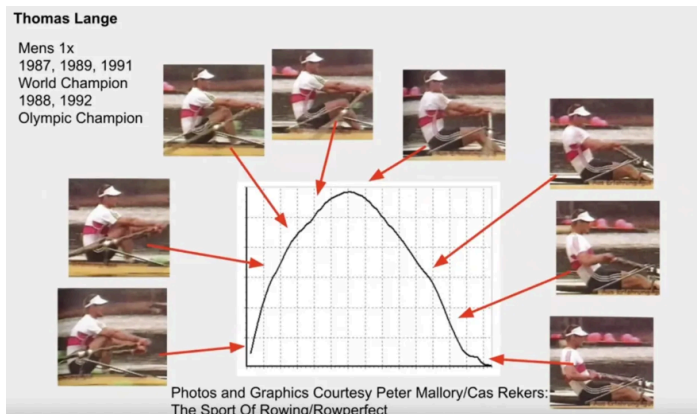
### Kernschlag

**Kernschlag curves are in the vast minority of successful crews, far less than 10% at the international level.**

### Schubschlag

Photos and Graphics Courtesy Peter Mallory/Cas Rekers:  
The Sport Of Rowing/Rowperfect

Based on a large dataset with more than 30 years of rowing data, growing over the years.



The force curve of former World & Olympic Champion Thomas Lange (GER) is a nice benchmark to aim for as an 'ideal' curve.

### Fingerprint

A Force Curve is almost like a fingerprint. An experienced rower often still has his 'own' personal curve shape years later. The more talented and experienced rowers can often adjust their (own) force curve as a kind of 'chameleon' in the boat during the race in such a way that it benefits the circumstances and/or team dynamics more. In a 'magical' (the elusive definition of talent) way they can find the efficiency optimum to benefit the crew performance.

The challenge for the coach, or for the rower as a self-coach, is to learn and train how to improve the personal curve where possible and to train the properties of the 'chameleon'. So to discover where the personal emphasis should be when it comes down to it, or if the rower has to respond to the circumstances. The *feeling* that needs to be developed here can be coached with good and direct feedback.

In favor of the boat speed, synchronization of the force curves of the crewmates is sought. For certain boat types and/or boat positions, a slightly different curve can be useful or even beneficial. With insight into the mutual curves and the effect of certain specific exercises, plus here again the direct feedback, this mechanism and the synchronization can be trained.

In addition to the theoretically best or most successful (best performance) force curve, in practice it is rather the pursuit of optimizing the best average team curve, which can then be translated into a personally desired curve.

## Problem Definition

Power curve, and derived or vice versa, Force curve training and optimization is a logical part of a rowers training schedule. How can you best use insights regarding the personal curve as a coach and use it as a rower?

A standard rowing training schedule consists of the following parts:

1. **Boat training**
2. **Indoor rowing** / ergometer: getting fit / fitter to be able to row better, also because it is not always possible to train on the water.

*note: when training on an ergometer, organize as much good and useful technical feedback as possible to improve and optimize the most effective power curve*

3. **Strength training**: to become stronger in order to be able to deliver more power during the stroke
4. possibly, **Other sports**, e.g. cycling: as an alternative endurance training
5. **Measuring** in the boat: by recording speed under the different conditions, the rower or crew knows, over time, what the progression and effect of certain improvements and training is.

Knowing how to make the crew or rower technically more efficient / effective, to improve the curve in the boat and for synchronization, boat measurement systems can be used.

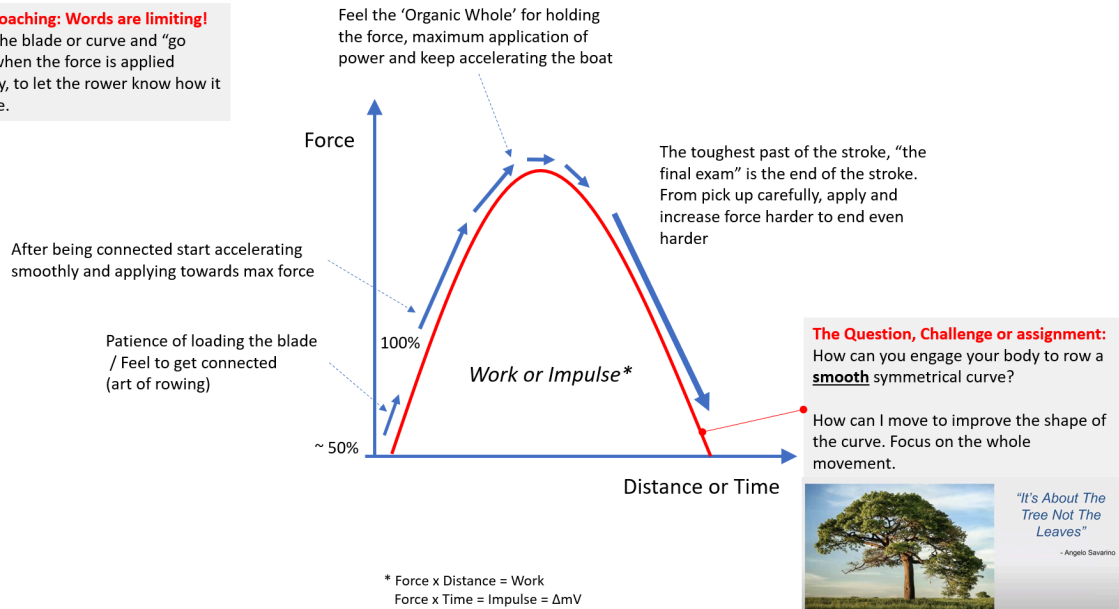
A personal force curve can only be changed over a longer period of time and with direct feedback. There are several practical examples and drills<sup>1</sup> to repeat that can adjust the character of the curve. It is also possible to train the flexibility to adjust the curve at the desired moment - like a 'chameleon'. By providing insight into the effect of adjustments and training on the expected deviating situations through direct interaction with the rower during training, but also knowing what the rower's reaction is to a certain change.

---

<sup>1</sup> Ask for the: Use the "10 Commandments" of Rowing with RP3 - white paper document

The power curve can be measured and visualized in the boat and on an indoor rower / ergometer. Only an accurate presentation of the power curve during technical training can provide the desired feedback for optimization and training of the higher quality curve.

**When coaching: Words are limiting!**  
Watch the blade or curve and “go crazy” when the force is applied correctly, to let the rower know how it feels like.



When training indoors with only numbers on the monitor, coaching will be, just like in the boat, mainly focused on 'posture improvement' (coaching on posture and movement) and therefore less on forming the improvements in the curve (the optimal pressure development).

The challenge for every rower, team and coach: what is the best approach to training and learning that the athletes use their fitness and strength to give the boat the highest speed to win the race?

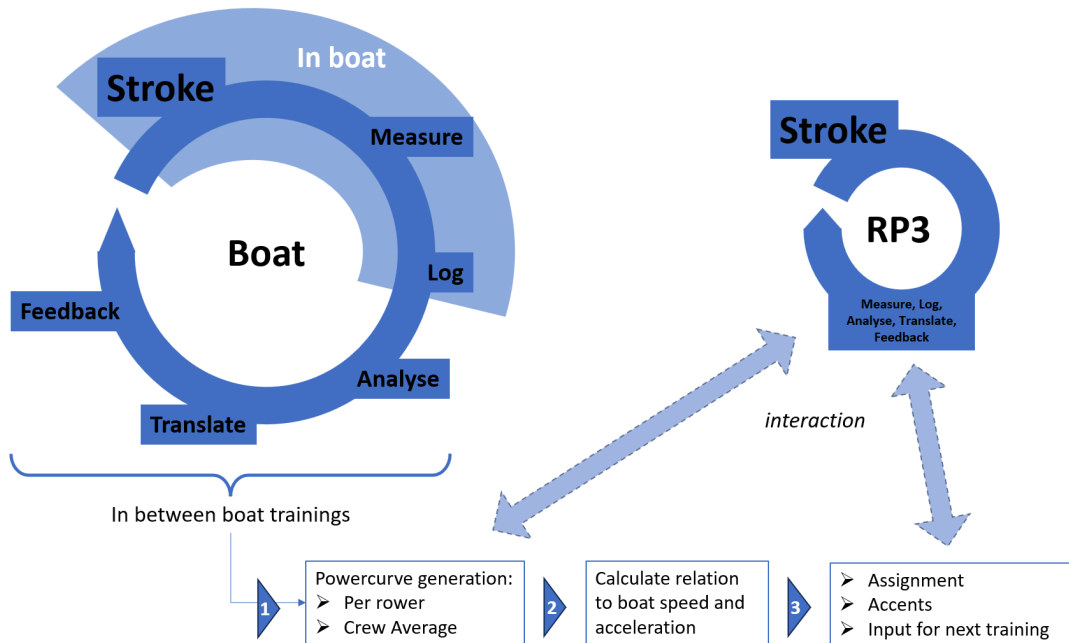
### High Level Solution

An additional system / installation is required to measure the curve(s) in the boat. The cycle of applying and optimizing the power curve is: stroke - measure - log - analysis - feedback - next stroke.

By making this cycle as short as possible (“close the loop”), learning is the fastest. Combining figures/data **and** the shape of the power curve on an intuitive, readable interface with applicable instructions is a precondition for optimizing the rowing stroke.

The measurement and feedback cycle in the boat is longer than on the indoor rower / ergometer because the analysis, establishing the relationship with curves and boat speed and acceleration during stroke, the translation to the personal curve and the translation to coach assignment, the emphasis for the rower or input for the next training, should always be made afterwards.

With a faster and direct measurement and feedback cycle on the indoor rower, in combination with the relevant figures on the monitor, the assignment can be made applicable and trainable after analysis from the boat by isolating the impact of the individual rower.



## Solution Details

The challenge for the coach, including the self-coach, is training the rower: activating the feeling when performing the rowing stroke and 'turning on' or being able to use the "chameleon" in the rower more and more. The adaptability to his own rowing stroke: being able to deliver the power in the most effective way for the benefit of the boat's speed and to maintain it throughout the journey. Simultaneously with being able to perform synchronously with each other.

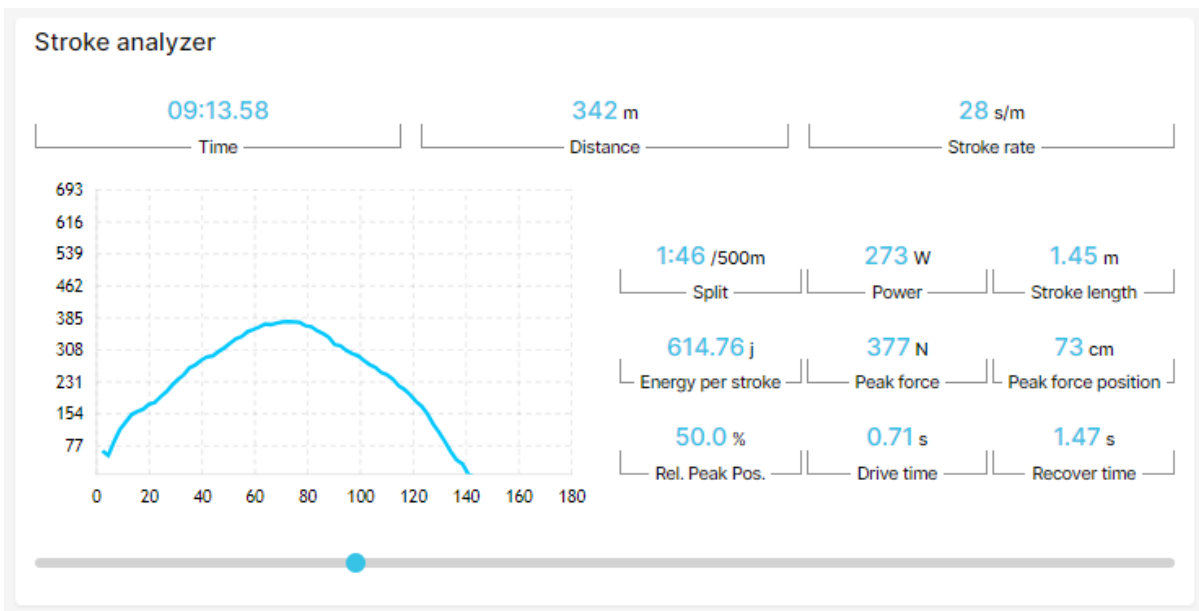
Being able to isolate the impact of the individual rower on team performance, through analysis and training of the rower as a whole, is the challenge. By always organizing the desired feedback in the measurement and feedback cycle, the learning and improvement effect increases. The data is relevant as dynamic indoor rowing almost seamlessly matches rowing in the boat. You have to turn less / almost no mass before you start the stroke on a dynamic rower, similar as in the boat.

RP3 provides instantly relevant and easy to interpret stats and the shape of the curve while you are rowing. A very useful part of "Closing the feedback loop".

Coaches can watch live, but also after the training via the analysis functionalities via the RP3 Portal.



Coach function provided by RP3 Rowing with second screen

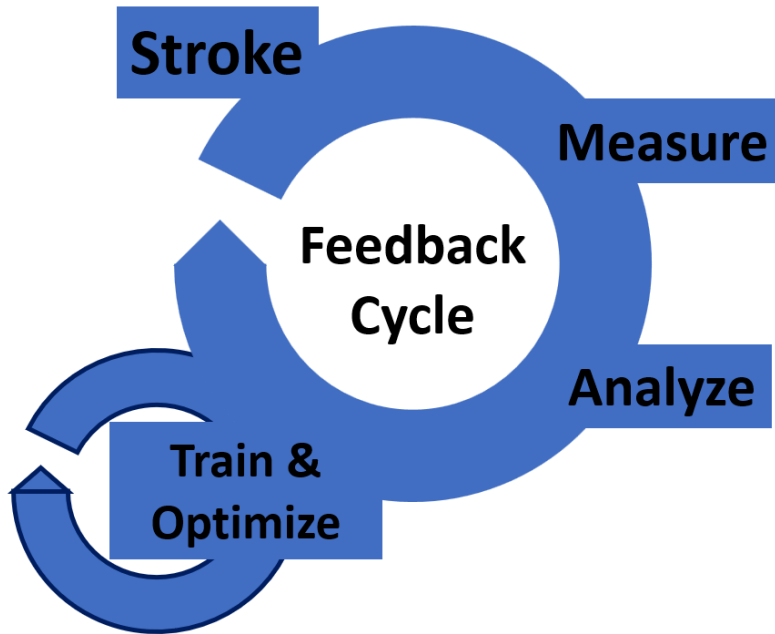


Stroke Analyzer function (RP3 Portal) provided by RP3 Rowing for training (stroke) analysis

Note:

- maximum power application in a boat is lower than measured on an indoor rower (Source: Dr. V. Kleshnev).
- maximum power application in the boat is depending on actual boatspeed: the higher the boatspeed the more difficult it is to contribute.
- lateral forces with the movement off the blade in the water is causing loss of power in the forward direction of the force application. That is not the case on the indoor rower, so explanation of the difference.
- slip of the blade in the water is causing loss of power application to benefit boatspeed.

The combination of the two rowing feedback cycles is to be optimized when using powercurve data to improve rower and crew capability.



**Double feedback cycle:** Boat - Measure & Analyze - Train & Optimize (“close the loop”) with direct feedback on the curve - by using a dynamic indoor rower which best / closest simulates rowing.<sup>2</sup>

## Benefits

- RP3 Rowing provides an accessible way to train the boat rowing movement on land
- Direct feedback via the visualization of the power curve, with associated metrics, offer the rower the opportunity to improve his curve
- Direct feedback provides a great learning effect when simulating conditions and helps the rower train feeling and adaptability
  
- Different forms of training are offered (precisely to) train deviations and flexibility of the rower: eg. via own target curve and desired optimal crew curve calculations and setting
- RP3 Rowing thus offers a palette of coach options to optimize the individual and team curve (including the connection system for synchronization)
- Coach functions available to watch directly during the training on RP3 and to support visual coaching with the measured values, and the possibility to check the session afterwards via RP3 Portal
- Figures and numbers correspond to the power curve in the boat because the rowing movement (with a dynamic character) is almost identical to rowing in the boat

<sup>2</sup> Elliott BC, Lyttle A, Birkett O. The RowPerfect ergometer: a training aid for on-water single scull rowing. Sports Biomech 2002; 1 (2): 123-34.

Also mentioned by Clara Soper and Patria Hume. Towards an Ideal Rowing Technique for Performance. The Contributions from Biomechanics in Sports Med 2004; 34 (12) paragraph 2.2

Version available on request: [info@rp3rowing.com](mailto:info@rp3rowing.com)



- Measurement, analysis data, outcome from the boat (via additional measurement systems) can be actively trained on the RP3 and then tested again in the boat to measure the improvement - combination of the double measurement and feedback loop

## Summary

To improve the rower's rowing skills, actively using the power curve, with direct feedback per stroke, has a major impact on the improvement and the ability to cope with changing conditions.

The role of the coach, with insight into the rowers powercurve, is to hold a mirror up to the rower and give tips to improve his stroke in the situation in question, individually and in his crew. While most coaches mainly coach visually, external (like speed and stroke rate) and internal (like power application, stroke length and slip) data can play a major role in improving the performance of the rower and the team.

By applying the "close the loop" principle between boat and land training, the improvement and learning potential of the rower is even further increased.

## Call to Action

If you want to know more or experience the added value of using RP3 (full proposition) yourself, please send a mail to: [info@rp3rowing.com](mailto:info@rp3rowing.com) , go to your local RP3 dealer, or go to the website: [www.rp3rowing.com/contact](http://www.rp3rowing.com/contact)