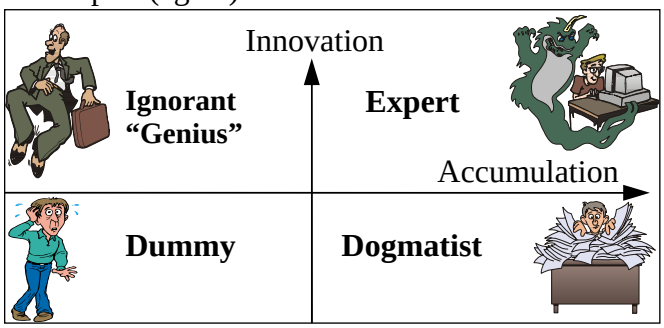
Q & A

? **Q.**: In RBN 6/2005 you discussed different types of coaches from a scientist's point of view. To be fair, it would be interesting to speculate about types of sport scientist from a coach's point of view.

V **A:** In the coach's quadrant we set the Y axis as ambition to use sport science. A scientist must have this ambition by default. Therefore, we will use another coordinate system: let the X axis represent ability to accumulate available knowledge in a specific area; the Y axis will be ability to develop new knowledge, i.e. research, invent, create something new. Let's conditionally call the four types of scientists Dummy, Dogmatist, Ignorant "Genius" and Expert (again):



Dummy is a person without good knowledge in the specific area and with no ability to learn or develop new things. This individual can be called a "scientist" by mistake only. However, it happens that a person with good manipulation skills or a loud commanding voice can find a position in science instead of placing himself in the administrative area. Life is not easy for this person. He/she is always anxious about his/her professional weakness. Usually this person picks up some fashionable ideas or technologies and uses them everywhere as a panacea, with or without a reason. Obviously, results are unpredictable and very often could be dangerous. Coaches should be very careful with this sort of person and can utilise them on minor tasks only, e.g. time-keeping, and equipment maintenance.

Dogmatist has read a lot of books and papers. He knows virtually everything not only in the specific area, but also many other things. It is very easy to understand what this person is talking about. He shares the opinions of many people, but he can hardly develop his own point of view. If established methods, testing protocols and analysis packs can be found, then Dogmatist can do a job successfully. However, in most cases it is necessary to define if a method would work or not, to adjust available knowledge to current conditions, which can be controversial. Here problems arise for Dogmatist. Quite often he loses the ability to make sense of known facts and ideas, or to put them together. It is extremely difficult for Dogmatist to invent something new. If he has to do research, he usually selects an objective, which is obvious without any investigation, e.g. stronger athletes produce higher power, etc. Coaches can use knowledge accumulated by Dogmatist, but they have to work out the application of concepts themselves.

Ignorant "Genius" is very good in "reinventing the wheel". Usually he has no specific education and does not care to learn what is already known. This person believes that only his ideas are important and everything done before by other people is "rubbish". Usually his ideas are very difficult to understand and people think that this person is "crazy". It is hard to talk to "Genius", he speaks in his own language and needs to be interpreted. This person is excellent in innovation, but results can be next to zero, because similar things were already invented. When such high ambitions are well grounded, and the person is really talented, then it makes sense to help and persuade him to learn. However, quite often the "Genius'" ideas are inadequate or wouldn't work in real conditions. Sceptical attitudes can make him aggressive and this can be a real problem for colleagues.

Expert is good in both accumulation and development of knowledge. He/she has learned everything that is available in the area, analysed it and found out where is a real "bottle neck" of the knowledge stream. At lower level, an Expert can find missing parts of the mosaic, do research projects and put them in place. At higher level, an Expert creates the "mosaic" structure himself, i.e. he/she creates a scientific theory, which explains and incorporates known facts. An Expert continuously develops his ideas and concepts, which can be difficult for coaches to follow. Something that is true today can be false tomorrow, which requires adjustment of training methods and technique.

Conclusion. Sport science has become very popular these days, but a coach needs to be aware what sort of scientist he/she works with. As it was with the coaches' types, the two opposites Dogmatist and "Genius" can make an efficient pair.

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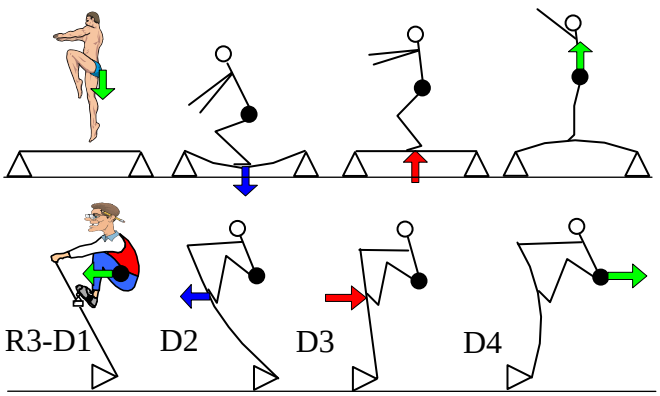
Ideas

V Recently we reached an interesting interpretation of our theory of rowing micro-phases (RBN 2004/1, 2 & 12). We call it the "**Trampoline effect**", which occurs at the catch and in the first half of the drive. The following logical steps will help us to understand the effectiveness of this theory:

1. To increase the boat speed, rowers have to expend more power to overcome higher drag resistance ($P = kV^3$).
2. The kinetic energy of the whole boat-rower system can be increased (accumulated) only during the drive phase. Increase of the shell velocity during the recovery is explained by transfer of the crew's kinetic energy (RBN 2004/7).
3. Because a crew's mass is higher than that of a boat, it accumulates 5-6 times more kinetic energy than the boat ($Ek = mV^2/2$). Therefore, the main target of an effective drive phase is to increase the velocity of a crew's centre of mass (CM).
4. The only force accelerating the rower's CM forward is the reaction force on the stretcher. The handle force pulls the rower backwards.
5. To apply a high stretcher force is not enough for a rower's acceleration. The stretcher must have a supporting connection to the water through the rigger and oar.
6. The stretcher (and the whole shell) has to move fast forwards at the moment of the leg drive.

In fact, rowing can be considered as a series of jumps. Each drive phase is a jump and recovery is a flight phase. The longer the jumps or higher their frequency, the higher the rowing speed. The major difference between rowing and real jumps is that rowers have to create support on the stretcher for themselves by placing the blade in the water and applying handle force. The picture below shows the analogy between rowing and real trampoline jumps. The "**Trampoline effect**" works as follows:



1. At the catch (end of R3 and D1 micro-phases), the rower approaches fast towards the stretcher and creates an impact push on the stretcher at the moment of the blade immersion.
2. This impact force is transferred though the rigger and pin to the oar sleeve and bends the oar (D2 micro-phase). The oar shaft accumulates elastic energy, which could amount to 25% of the total power at the catch (RBN 2001/05)
3. In the D3 micro-phase, the oar shaft springs back, i.e. the oar works as a trampoline. The recoil force goes back though the pin and rigger and creates a high positive boat acceleration called the "first peak".
4. Rowers use the accelerating stretcher as a support for effective acceleration of their CM during the D4 micro-phase.

The "**Trampoline effect**" theory can have a number of consequences. Here are some of them:

1. Fast approach to the stretcher before the catch is beneficial. This contradicts some theories, which propose a slower approach to the catch.
2. Good timing is really important. Each rower has to feel the moment when he/she: a) kicks "the trampoline" and bends it; b) applies the handle force to support "the trampoline" from the other side; c) picks up the recoil force and uses the legs to accelerate the body CM.
3. In crew boats, all rowers have one common trampoline because their stretchers are connected through the shell. Therefore, one rower can create the trampoline effect for other rowers in the crew. This happens quite often in pairs, where the stroke rower increases force much more quickly than the bow rower.
4. Optimal stiffness of the oar shaft is important and should correspond to the magnitude of the impact force. Oar shafts that are too soft or too stiff will decrease the trampoline effect.
5. Rowing on ergometers does not allow experiencing the trampoline effect.

What sort of drills can we use to improve the trampoline effect?

The best drill is to row using legs only with emphasis on fast explosive work through the stretcher. It is better to do this drill with the whole crew (not by seats), because the large passive mass of sitting rowers will significantly decrease the boat acceleration and trampoline effect.

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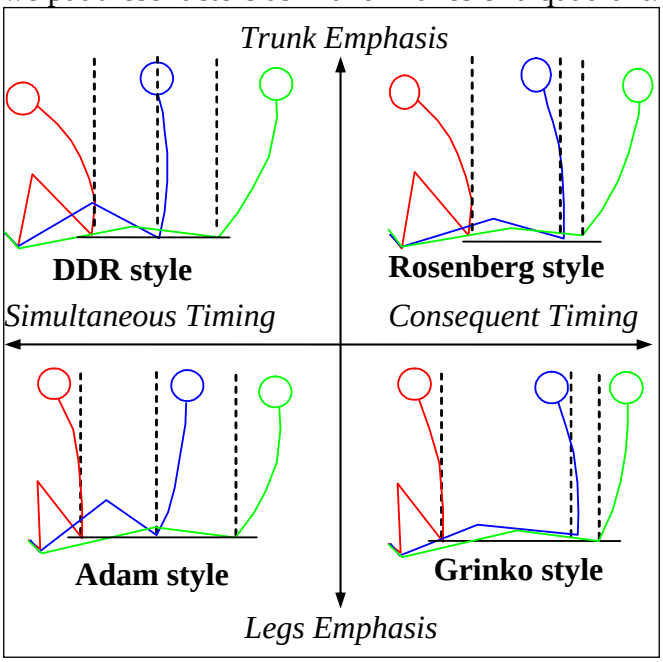
Ideas

V The most popular classification of rowing styles was introduced by Klavora in 1977 (1) and defined three rowing styles: the Adam style; the DDR style; the Rosenberg style:

- **Adam** - Comparatively long legs drive and limited amplitude of the trunk. Simultaneous activity of legs and trunk during the stroke;
- **DDR** - Large, forward declination of the trunk, which begins the drive, followed by simultaneous activity of the legs;
- **Rosenberg** - Large, forward declination of the trunk at the beginning of the stroke, then strong leg extension without significant trunk activation. At the end of the cycle the trunk stops in the deep backward position.

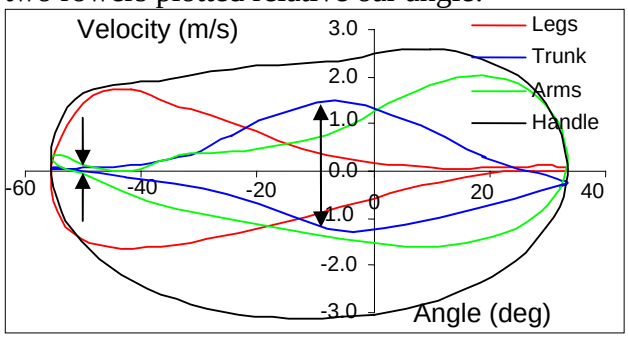
We defined two main factors, which distinguish these styles: timing (simultaneous or consequent activity of two biggest body segments) and emphasis during the drive (on legs or trunk). Then we put these factors as X and Y axes of a quadrant:



We found that the three styles perfectly fit three quarters. However, we found that the fourth rowing style must exist. This style has consequent timing and emphasis on the legs drive. We called it "**Grinko style**" after the name of talented Russian coach Igor Grinko, who practises this style. Igor coached many World champion scullers in USSR and USA. One of them is Silver Olympic medalist in M1x Jueri Jaanson (Appendix 1).

It is not very often we can see a pure example of these rowing styles. Most of the rowers have a style somewhere in between of these four extremities.

V We found that very often the sequence and velocities of the segments on recovery mirrors the sequence on the drive. If we plot the segments velocities relative oar angle, they will look like mirror images, where the negative part (recovery) resembles positive part (drive). Below are charts of two rowers plotted relative oar angle:



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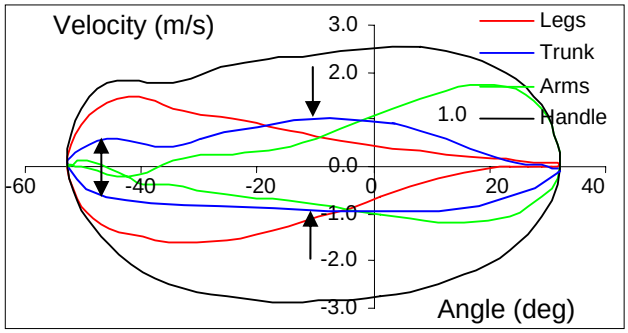

2

The first rower prepares his trunk earlier during recovery and approaches the catch with legs only. The trunks is ready for the drive (trunk speed is nearly zero). This rower has fast legs drive strait after the catch and increase trunk velocity in the second quarter of the drive. As we discussed in RBN 2001/07 this "consequent" rowing style produce higher relative maximal force and power.

The second rower spreads the trunks movement across the recovery and continues tilting the body until the last moment before the catch. As a result, this rower "opens the body" early during the drive and spreads its movement across the drive. This "simultaneous" rowing style produces lower maximal force and power, but the shape of force curve is more rectangular.

An interesting practical application of this principle could be the following: I you want to achieve certain sequence and velocities of the segments during the drive, you should practice the mirror sequence and velocities during recovery.

References

1. Klavora P. 1977. Three predominant styles: the Adam style; the DDR style; the Rosenberg style. Catch (Ottawa), 9, 13.

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Appendix 1 to the Rowing Biomechanics Newsletter 60(6), March 2005.

Drive phase of Jueri Jaanson during final race of 2004 Olympic Games in Athens.

News

Our Rowing Biomechanics Newsletter celebrates its 5 year anniversary! The first RBN had seen the world in April 2001. 60 issues were published since then. Originally, it was intended for a small audience of Australian coaches. However, the popularity of the Newsletter has grown amazingly. Now it has more than 200 subscribers from all over the World and a dedicated web site *www.biorow.com*. It is regularly translated into Russian and some issues were translated into German and French.

I want to thank specially the great swimming coach Gennady Touretsky, who inspired me for this project.

Thanks to everybody who contributed to the success of the Newsletter. Your feedback, comments and questions are very important stimulus for further development of rowing Biomechanics.

Q&A

V We received positive feedback from Igor Grinko in regards of rowing styles classification published in previous Newsletter. Now Igor is working in China and doing his best to get the Chinese rowers ready for their first home Olympics in Beijing-2008. He said: "Actually you are right about my style of rowing. I remember when my guys won the first gold medals in 4x in 1986-87, the coaches' comments were: "I don't understand how they could win with this technique". However, a few years later coaches understood this style better and tried to copy it. Also, Viacheslav Ivanov (three times Olympic champion in single scull) told me in 1987, that he likes the style I was teaching. He said that it is very close to what he thinks about good rowing technique"

? **Q:** Cas Rekers, inventor of the RowPerfect rowing machine has asked us a question about the second section of the previous Newsletter: "In normal rowing, the time for the recovery is longer than the time for the stroke. … I timed a video tape of the Dutch eight in Atlanta Olympic Games; they had a drive time of around 0.6s, at a stroke rate of 38 str/min, resulting in a ratio of around 1.6 between drive time and recovery time. … In both your graphs however the handle speed during the recovery is higher at any moment of the cycle. In my opinion they should in both cases be roughly a factor 1.5 lower. Could you please explain?"

V **A:** We already published some analysis of the rhythm and drive/recovery times in RBN 2003/03, which you can find on our Web site. The analysis was based on an extensive data base (more than 7000 samples) of measurements done using the telemetry system, which is more accurate than video. We measure drive from the moment when the oar changes direction at the catch till the similar moment at the finish. You can see that the average drive time in 8+ is about 0.85s at a stroke rate of 36 and about 0.75s at 44 str/min.

If one measure drive using placement of the blade into the water, then the drive time will be shorter and the rhythm percentage lower. It is quite likely that this can be the case in Cas's measurements using video. In the examples given in the previous Newsletter for two rowers in pairs, the stroke rates were 36.2 and 36.4 respectively, drive times 0.90 and 0.94 and rhythm values 54.3% and 57.1%, i.e the recovery time was 1.19 and 1.33 shorter than the drive time. Therefore, the handle speed must be on average 1/3 faster during recovery, than during the drive.

Facts. Did you know that…

…high handle speed during recovery is linked with another interesting issue: aerodynamical resistance of the blade. The blade velocity is higher than the handle velocity by an inboard/outboard ratio. E.g., the maximal handle velocity 2.92m/s in 8+ at 40str/min (RBN 2002/07) would give us 6.88m/s velocity of the centre of the blade. Boat velocity also contributes 7.03m/s to it (during the recovery it is higher than the average boat speed, RBN 2004/07). This gives us nearly 15m/s or 54km/h blade speed relative to the air, which is more than a race speed of a good cyclist. At this speed the air drag of the blade is very significant. It contributes about 3% of total drag at calm conditions and more than 10% at the head wind of 5m/s.

If a crew squares the blade early during recovery, this increases drag resistance dramatically. Engineers from Southampton University made calculations, which show us that every 10deg of early squaring blade before catch would add about 1.5s to the 2k race time and 3s at head wind 5m/s. Quite often we can see that some crews square the blade virtually at the middle of the recovery and lose about 5s and much more at head wind.

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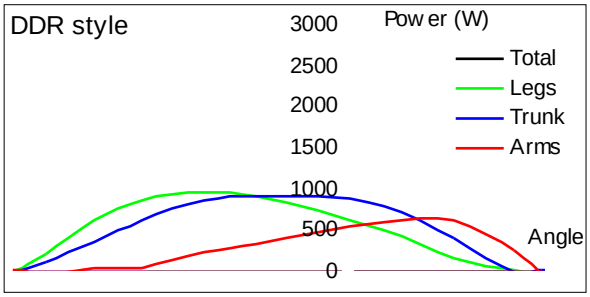
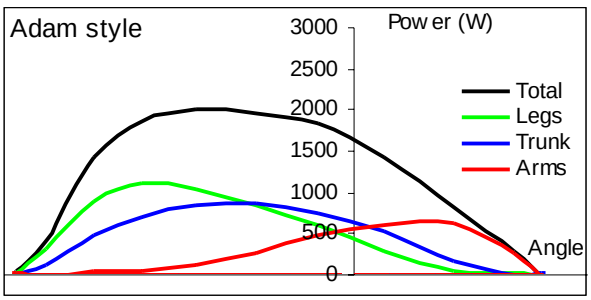


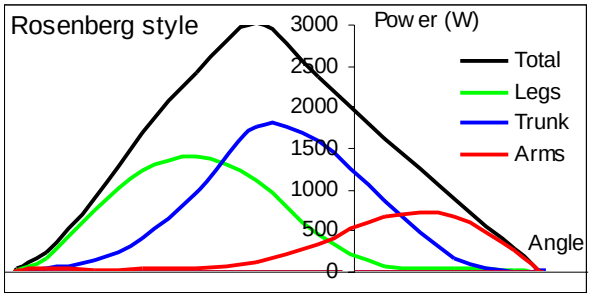


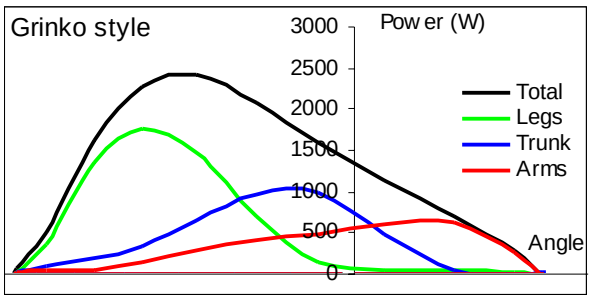
Simultaneous work of the legs and trunk (both German rowing styles) produces a more rectangular shape of the power curve, but the peak power is lower. More even pressure on the blade improves its propulsive efficiency. However, slower and more static movement of the legs and trunk does not allow the delivery of the optimal power.

Sequential work of the legs and trunk (Rosenberg and Grinko rowing styles) produce a triangular shape of the power curves and higher peak power values. This leads to higher slippage of the blade through the water that causes energy losses. However, lower blade propulsive efficiency can be more than compensated by higher values of force and power produced per kg of body weight. Active usage of the trunk produces even more power, so the Rosenberg style can be considered as the most powerful rowing style.

Emphasis on the legs or trunk affects the position of the force and power peaks. Styles with leg emphasis (Adam and Grinko styles) allow a quicker increase of the force and earlier peak of the force curve. This improves the initial boat acceleration micro-phase D3 (RBN 1-2/2004) and makes the drive timing more effective.

Styles with trunk emphasis (Rosenberg and DDR styles) produce more power owing to better utilisation of big muscles (gluteus and longissimus muscles). However, these muscles are slow by nature as they are intended to maintain body posture in humans. This fact does not allow a quick increase of the force and power when using trunk muscles. A shift of the peak of the power curve closer to the middle of the drive makes the temporal structure of the drive less effective.





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