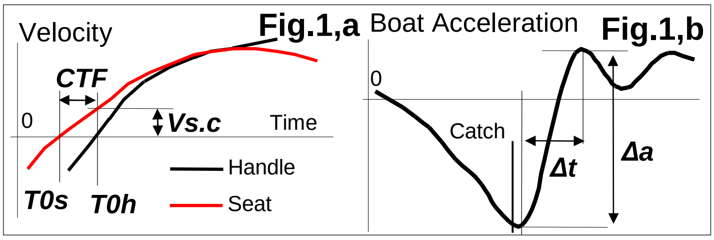
Catch indicators

The “catch through the stretcher” concept was described in the RBN 2006/09 and the case study was given in RBN 2014/04. Digital indicators of the catch technique will be defined here, which would help to evaluate it clearer, more accurately and reliably. The first indicator of the coordination of a rower’s movements at the catch was defined as the time difference in ms between moments of changing direction at the seat ***T0s*** and at the handle ***T0h*** (Fig.1,a), and was called “Catch Timing Factor” ***CTF***:

$$CTF = T0s - T0h \qquad (1)$$

Negative values of ***CTF*** mean the seat changes direction first, then the handle; and vice versa.



In a large data sample, an average ***CTF*** was found as a negative, with a higher magnitude in sweep rowing (-23.0±24.0ms mean±SD, n=11990) than in sculling (-5.9±16.9ms, n=8752). The difference could be explained by longer catch angles in sculling, which make dynamic gearing heavier, so the handle movement could be slower to provide the blade work in the water. This was confirmed by the fact that ***CTF*** had 4-6ms higher negative magnitude in bigger/faster boats, i.e. higher boat speed requires earlier legs engagement. High standard deviation SD means this variable ranges quite widely: from -95 to +49ms in sweeping and from -56 to +44 in sculling. In the World’s best rowers, the ***CTF*** was found as -30 to -45ms in sweeping and -15 to -30ms in sculling, so our target ranges were set correspondingly.

Another catch indicator was defined as the seat velocity at the catch ***Vs.c***, when the handle changes direction. Its average values were found 0.16±0.16m/s in sweeping and 0.05±0.13m/s in sculling, so the target values were set 0.2-0.4 and 0.1-0.3m/s, correspondingly. Obviously, there is strong correlation (r=-0.88) between ***CTF*** and ***Vc.s***, which means the earlier the seat changes direction, the higher its velocity at catch.

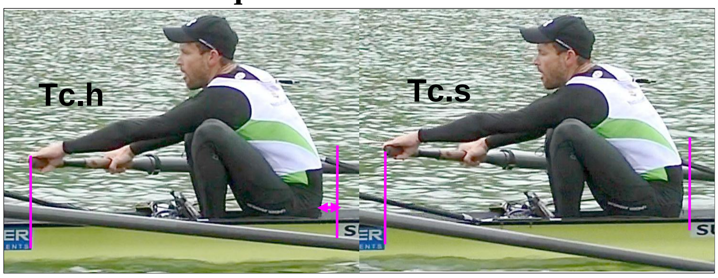
CTF had a mild correlation with average force production (r=-0.31) and work per stroke (r=-0.29), which could be interpreted in two ways: either an earlier direction change of the seat (higher negative magnitude of ***CTF***) helps to produce higher force/power, or bigger/stronger rowers tend engage legs earlier.

Determination of ***CTF*** and ***Vs.c*** require the use of special sensors, which are components of the *BioRow™* system. Will it be possible to define catch indicators with simpler tools, say, using the boat acceleration? It was shown (RBN 2012/11) that the best crews have deeper negative peak of the boat acceleration at the catch, then, it grows steeper. To combine these two features, the gradient of the boat acceleration ***Ga*** was defined (Fig.1,b):

$$Ga = \Delta a / \Delta t \qquad (2)$$

Where ***Δa*** is the difference between negative and the first positive acceleration peaks, and ***Δt*** is the time between them. As ***Ga*** significantly depends on the stroke rate (r=0.72), but the ***CTF*** does not (r=0.12), residuals of ***Ga*** from its rate-based trend were analysed. Surprisingly, very small correlations of ***Ga*** were found with ***CTF*** (r=-0.11) and ***Vs.c*** (r=0.19). This means earlier change direction of the seat only slightly increases gradient of the boat acceleration. The most significant correlation of ***Ga*** was found with the time from the catch to the maximal seat velocity (r=-0.60) and with the time to increase force up to 70% of the maximum (r=-0.75). This means **an earlier change of the seat’s direction is desirable, but is not a sufficient factor of a dynamic effective catch. More important factors are quick acceleration of the seat after the catch and steep force increasing.**

CTF and ***Vs.c*** are individual indicators for each rower, but ***Ga*** is the variable of the whole boat. Therefore, **good synchronisation of the rowers’ movement at the catch is required to make it effective**.



The main argument against the “catch through the stretcher” concept was heard that the seat movements is unloaded at catch, so this is the “waste of energy” of rower’s legs – “slide shooting”. In fact, the seat travels only about 1cm during the target ***CTF*** time -30ms – between the moments of direction change at the seat and the handle (Fig.2). The blade at this moment still moves forward to the bow and is only approaching the water, so it is still unloaded. **Earlier change of direction of the seat helps to accelerate the rower’s mass relative the boat and use its movement for a quicker increase of the force production, which is called “using your weight”. A similar principle is used in many other ballistic movements: accelerating the mass first, then taking the load.**

Concluding, **an effective and dynamic catch requires precise timing of the seat and handle movements, quick blade insertion, fast seat acceleration and increase of force, as well as good synchronisation of these factors in a crew.** All these catch factors are now included in BioRow™ testing reports.