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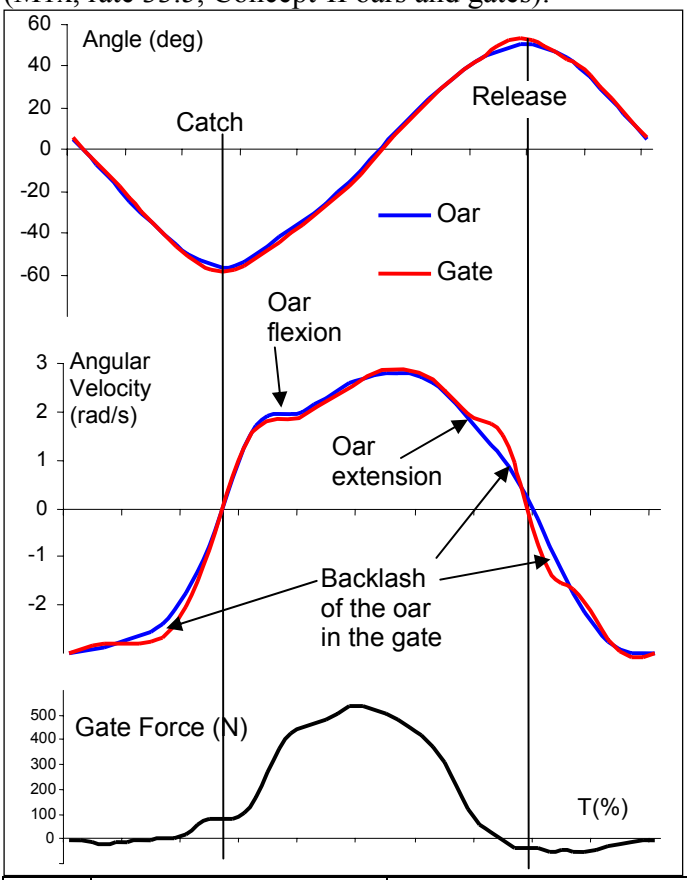
Facts. Did you know that...

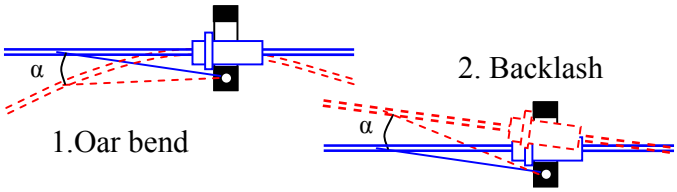
✓ …oar and gate angles can be quite different? A brief simultaneous measurement of these two angles was conducted last year. Here are the results (M1x, rate 33.5, Concept-II oars and gates):



	Gate Angles (deg)			Oar Angles (deg)		
	Catch	Release	Total	Catch	Release	Total
Right	-57.5	53.9	111.4	-56.3	50.3	106.6
Left	-59.9	54.9	114.8	-59.0	52.1	111.1

The total angle measured at the gate was 4-5° longer than the total oar angle. This occurred mainly by means of release angles, which were 3-4° longer at the gate. At lower ratings the gap was less (2-3°).
Calibration errors are unlikely to be the cause as both angles were calibrated twice with the same method. Both left and right sides showed similar results.
Two reasons of this phenomenon can be speculated:

1. A bend of the oar shaft. When force increases at the first half of the drive, angular velocity of the oar is slightly higher. At the second half of the drive the oar extends, its rotation appears to be slower than the gate rotation. Oar bend probably is the reason of small difference in catch angle and has no affect on finish angle, because the force at this point is minor.
2. Backlash of the oar sleeve in the gate is probably the main contributor to the difference in angle readings. It depends on geometry of the gate, sleeve and button, plus coordination of feathering along with horizontal and vertical movements of the oar. It is difficult to predict the amount of backlash that varies with different rowers.



Ideas. What if…

? Which angle should be measured in rowing biomechanics? This question corresponds closely to another one: should force be measured at the gate or at the oar? There is no simple answer to these questions and it depends on what, actually, needs to be measured.

✓ If the target is geometry and kinetics of rower's movement, then oar angle and force are the best choice. The main advantage of this method is accurate determination of the handle position and power produced by rower. However, the force applied to the pin can not be derived precisely, by not knowing exact points of the forces application at the blade and handle, therefore, actual leverage of the oar is unknown.

✓ If boat kinetics and propulsive forces need to be measured, then gate angle and force are more useful for defining force components at the pin. However, the rower's power can be estimated quite roughly from the reason mentioned above: unknown actual leverage of the oar.

? Is backlash of the oar in the gate a real problem for rowers? Does it decrease the length of the drive and efficiency? We would answer to these questions negatively, providing the backlash is reasonable. There is, practically, no backlash at catch and during the drive, because applied forces firm press the sleeve to the gate. The backslash at release occurs, when blade is already out of water and there is minimal force applied to it.

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