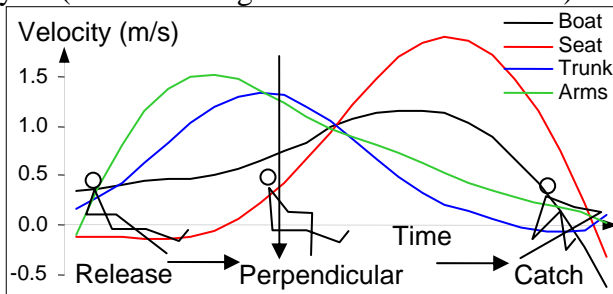


Q&A

Q: Nick Garratt, Head Coach of Mosman Rowing Club, Sydney, Australia is asking: “My athletes now row with very fast hands away and body over after the release... The changes are particularly noticeable at the current training rating of 18-20, and I suppose it could be argued that at race rate of 30-34 the recovery speed is pretty fast anyway. Does the boat speed increase when speeding the hands away and body swing, compared to the 'even speed in - even speed away' technique at the recovery? Or perhaps does the faster hands method allows more relaxation and recovery time and is therefore less fatiguing?”

A: In RBN 2004/07 we already discussed the boat velocity during recovery in conjunction with the stretcher force. We recommended minimising the stretcher pull, which makes the hull speed smoother during recovery. Now we will discuss the body segments' velocities. The chart below shows them (a positive velocity implying in the stern direction) in conjunction with deviation of the boat velocity from the average over the stroke cycle (data for a single sculler at 36.5 str/min):



At the beginning of the recovery, the velocities of the arms and trunk are quite high, but the boat speed increases only slightly. When the oar crosses the perpendicular position and the handles pass the knees, the seat velocity increases sharply, which causes displacement of the rower’s whole mass. To do this the rower has to pull on the stretcher, which increases the boat speed dramatically. The peaks of the seat and the boat velocities coincide. Then the rower pushes the stretcher, which decreases both the seat and the boat velocities. These variations of the boat speed are a source of small energy loss, which increases with the stroke rate (1).

A fast movement of the arms itself at the beginning of recovery has practically no effect on the boat speed, because the arms have a very small mass. However, acceleration of the handle must overcome the moment of inertia of the oar that creates a negative force on the pin and decelerates the boat. If this is performed at low rates, very often the handle pauses at the middle of the recovery,

which requires double activation of the muscles and is not good for balance and relaxation. At higher rates, this pause usually disappears, but the habit persists and can affect performance.

If a fast arms movement is connected with a fast trunk movement, then the rower has to use the stomach muscles very intensively. At higher rates this can be fatiguing. Also, it creates significant force on the seat, which pushes the boat downwards and increases drag (RBN 2006/10).

To conclude, at the moment we can guess that exaggerated speed of the arms and trunk is NOT a good way to start the recovery. More objective experiments are required to confirm the point.

Ideas. What if...

...you use our method of modelling the speed/rate relationship for developing normative splits for ergo training? In RBN 2005/10 and (2) we described the method and illustrated its application in race analysis. The method is based on the principle of constant effective work per stroke. Now we use its main equation on ergo:

$$V_I = V_0 (R_I / R_0)^{1/3}$$

Where V_I is the target speed at the rate R_I , and V_0 and R_0 are race speed and rate. The Appendix 1 gives you normative splits at various training rates, which target various results at racing rates 32, 36 and 40. You can download the spreadsheet from <http://www.biorow.com/Downloads.htm> and use it in case you want another race rate or different training rates.

Examples of using the Tables:

1. Your target for a 2k ergo race is 6:00 at the rate 36. If you can train at the rate 18 at a split of 1:53, this means your muscles are ready to produce the same amount of work per stroke, as required for your target result and rate.
2. You can train at a split of 1:48 at the rate 20. This means your muscles are ready to produce 2k race time 5:44 at the rate 40. If you can't produce this result, then you lack endurance.

Enjoy your smarter training!

References

1. Kleshnev V. (1999) Propulsive efficiency of rowing. In: Scientific proceedings : ISBS '99 : XVII International Symposium on Biomechanics in Sports, p. 224-228.
2. Kleshnev V. (2006) Method of analysis of speed, stroke rate and stroke distance in aquatic locomotions. In: Scientific proceedings. XXII International Symposium on Biomechanics in Sports, Salzburg. pp 104-107.

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Appendix 1 to Rowing Biomechanics Newsletter 79(7) October 2007

Table 1. Normative splits for Target Race Rate 32 str/min.

Target 2k time at Rate:	Split	Training 500m splits at different rates																					
		10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	
32	500																						
4:40	1:10	1:43	1:37	1:32	1:28	1:25	1:22	1:19	1:17	1:15	1:13	1:12	1:10	1:09	1:07	1:06	1:05	1:04	1:03	1:02	1:01	1:00	
4:48	1:12	1:46	1:40	1:35	1:31	1:27	1:24	1:22	1:19	1:17	1:15	1:14	1:12	1:11	1:09	1:08	1:07	1:06	1:05	1:04	1:03	1:02	
4:56	1:14	1:49	1:43	1:37	1:33	1:30	1:27	1:24	1:21	1:19	1:17	1:16	1:14	1:13	1:11	1:10	1:09	1:08	1:07	1:06	1:05	1:04	
5:04	1:16	1:52	1:45	1:40	1:36	1:32	1:29	1:26	1:24	1:21	1:19	1:18	1:16	1:14	1:13	1:12	1:11	1:09	1:08	1:07	1:06	1:05	
5:12	1:18	1:55	1:48	1:43	1:38	1:34	1:31	1:28	1:26	1:24	1:22	1:20	1:18	1:16	1:15	1:14	1:12	1:11	1:10	1:09	1:08	1:07	
5:20	1:20	1:58	1:51	1:45	1:41	1:37	1:34	1:31	1:28	1:26	1:24	1:22	1:20	1:18	1:17	1:16	1:14	1:13	1:12	1:11	1:10	1:09	
5:28	1:22	2:01	1:54	1:48	1:43	1:39	1:36	1:33	1:30	1:28	1:26	1:24	1:22	1:20	1:19	1:17	1:16	1:15	1:14	1:13	1:12	1:11	
5:36	1:24	2:04	1:56	1:51	1:46	1:42	1:38	1:35	1:32	1:30	1:28	1:26	1:24	1:22	1:21	1:19	1:18	1:17	1:16	1:14	1:13	1:12	
5:44	1:26	2:07	1:59	1:53	1:48	1:44	1:41	1:37	1:35	1:32	1:30	1:28	1:26	1:24	1:23	1:21	1:20	1:19	1:17	1:16	1:15	1:14	
5:52	1:28	2:10	2:02	1:56	1:51	1:47	1:43	1:40	1:37	1:34	1:32	1:30	1:28	1:26	1:25	1:23	1:22	1:20	1:19	1:18	1:17	1:16	
6:00	1:30	2:13	2:05	1:59	1:53	1:49	1:45	1:42	1:39	1:36	1:34	1:32	1:30	1:28	1:27	1:25	1:24	1:22	1:21	1:20	1:19	1:18	
6:08	1:32	2:16	2:08	2:01	1:56	1:51	1:48	1:44	1:41	1:39	1:36	1:34	1:32	1:30	1:28	1:27	1:25	1:24	1:23	1:22	1:20	1:19	
6:16	1:34	2:19	2:10	2:04	1:58	1:54	1:50	1:47	1:43	1:41	1:38	1:36	1:34	1:32	1:30	1:29	1:27	1:26	1:25	1:23	1:22	1:21	
6:24	1:36	2:21	2:13	2:06	2:01	1:56	1:52	1:49	1:46	1:43	1:40	1:38	1:36	1:34	1:32	1:31	1:29	1:28	1:26	1:25	1:24	1:23	
6:32	1:38	2:24	2:16	2:09	2:03	1:59	1:55	1:51	1:48	1:45	1:42	1:40	1:38	1:36	1:34	1:33	1:31	1:30	1:28	1:27	1:26	1:24	
6:40	1:40	2:27	2:19	2:12	2:06	2:01	1:57	1:53	1:50	1:47	1:45	1:42	1:40	1:38	1:36	1:34	1:33	1:31	1:30	1:29	1:27	1:26	
6:48	1:42	2:30	2:21	2:14	2:09	2:04	1:59	1:56	1:52	1:49	1:47	1:44	1:42	1:40	1:38	1:36	1:35	1:33	1:32	1:30	1:29	1:28	
6:56	1:44	2:33	2:24	2:17	2:11	2:06	2:02	1:58	1:54	1:51	1:49	1:46	1:44	1:42	1:40	1:38	1:37	1:35	1:34	1:32	1:31	1:30	
7:04	1:46	2:36	2:27	2:20	2:14	2:08	2:04	2:00	1:57	1:54	1:51	1:48	1:46	1:44	1:42	1:40	1:38	1:37	1:35	1:34	1:33	1:31	
7:12	1:48	2:39	2:30	2:22	2:16	2:11	2:06	2:02	1:59	1:56	1:53	1:50	1:48	1:46	1:44	1:42	1:40	1:39	1:37	1:36	1:34	1:33	
7:20	1:50	2:42	2:33	2:25	2:19	2:13	2:09	2:05	2:01	1:58	1:55	1:52	1:50	1:48	1:46	1:44	1:42	1:40	1:39	1:37	1:36	1:35	
7:28	1:52	2:45	2:35	2:28	2:21	2:16	2:11	2:07	2:03	2:00	1:57	1:54	1:52	1:50	1:48	1:46	1:44	1:42	1:41	1:39	1:38	1:37	
7:36	1:54	2:48	2:38	2:30	2:24	2:18	2:13	2:09	2:05	2:02	1:59	1:56	1:54	1:52	1:50	1:48	1:46	1:44	1:43	1:41	1:40	1:38	
7:44	1:56	2:51	2:41	2:33	2:26	2:21	2:16	2:11	2:08	2:04	2:01	1:59	1:56	1:54	1:52	1:50	1:48	1:46	1:44	1:43	1:41	1:40	
7:52	1:58	2:54	2:44	2:35	2:29	2:23	2:18	2:14	2:10	2:06	2:03	2:01	1:58	1:56	1:53	1:51	1:50	1:48	1:46	1:45	1:43	1:42	
8:00	2:00	2:57	2:46	2:38	2:31	2:25	2:20	2:16	2:12	2:09	2:05	2:03	2:00	1:58	1:55	1:53	1:51	1:50	1:48	1:46	1:45	1:43	
8:08	2:02	3:00	2:49	2:41	2:34	2:28	2:23	2:18	2:14	2:11	2:08	2:05	2:02	2:00	1:57	1:55	1:53	1:51	1:50	1:48	1:47	1:45	
8:16	2:04	3:03	2:52	2:43	2:36	2:30	2:25	2:20	2:16	2:13	2:10	2:07	2:04	2:02	1:59	1:57	1:55	1:53	1:52	1:50	1:48	1:47	
8:24	2:06	3:06	2:55	2:46	2:39	2:33	2:27	2:23	2:19	2:15	2:12	2:09	2:06	2:03	2:01	1:59	1:57	1:55	1:53	1:52	1:50	1:49	
8:32	2:08	3:09	2:58	2:49	2:41	2:35	2:30	2:25	2:21	2:17	2:14	2:11	2:08	2:05	2:03	2:01	1:59	1:57	1:55	1:53	1:52	1:50	
8:40	2:10	3:12	3:00	2:51	2:44	2:37	2:32	2:27	2:23	2:19	2:16	2:13	2:10	2:07	2:05	2:03	2:01	1:59	1:57	1:55	1:54	1:52	

Table 2. Normative splits for Target Race Rate 36 str/min.

Target 2k time at Rate:	Split	Training 500m splits at different rates																					
		10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	
36	500																						
4:40	1:10	1:47	1:41	1:36	1:32	1:28	1:25	1:22	1:20	1:18	1:16	1:14	1:13	1:11	1:10	1:09	1:08	1:06	1:05	1:05	1:04	1:03	
4:48	1:12	1:50	1:44	1:39	1:34	1:31	1:28	1:25	1:22	1:20	1:18	1:17	1:15	1:13	1:12	1:11	1:10	1:08	1:07	1:06	1:05	1:05	
4:56	1:14	1:53	1:47	1:41	1:37	1:33	1:30	1:27	1:25	1:22	1:20	1:19	1:17	1:15	1:14	1:13	1:11	1:10	1:09	1:08	1:07	1:06	
5:04	1:16	1:56	1:50	1:44	1:40	1:36	1:32	1:30	1:27	1:25	1:23	1:21	1:19	1:17	1:16	1:15	1:13	1:12	1:11	1:10	1:09	1:08	
5:12	1:18	2:00	1:52	1:47	1:42	1:38	1:35	1:32	1:29	1:27	1:25	1:23	1:21	1:20	1:18	1:17	1:15	1:14	1:13	1:12	1:11	1:10	
5:20	1:20	2:03	1:55	1:50	1:45	1:41	1:37	1:34	1:32	1:29	1:27	1:25	1:23	1:22	1:20	1:19	1:17	1:16	1:15	1:14	1:13	1:12	
5:28	1:22	2:06	1:58	1:52	1:47	1:43	1:40	1:37	1:34	1:31	1:29	1:27	1:25	1:24	1:22	1:21	1:19	1:18	1:17	1:16	1:15	1:13	
5:36	1:24	2:09	2:01	1:55	1:50	1:46	1:42	1:39	1:36	1:34	1:31	1:29	1:27	1:26	1:24	1:22	1:21	1:20	1:19	1:17	1:16	1:15	
5:44	1:26	2:12	2:04	1:58	1:53	1:48	1:45	1:41	1:38	1:36	1:34	1:31	1:29	1:28	1:26	1:24	1:23	1:22	1:20	1:19	1:18	1:17	
5:52	1:28	2:15	2:07	2:01	1:55	1:51	1:47	1:44	1:41	1:38	1:36	1:34	1:32	1:30	1:28	1:26	1:25	1:24	1:22	1:21	1:20	1:19	
6:00	1:30	2:18	2:10	2:03	1:58	1:53	1:49	1:46	1:43	1:40	1:38	1:36	1:34	1:32	1:30	1:28	1:27	1:25	1:24	1:23	1:22	1:21	
6:08	1:32	2:21	2:13	2:06	2:01	1:56	1:52	1:48	1:45	1:43	1:40	1:38	1:36	1:34	1:32	1:30	1:29	1:27	1:26	1:25	1:24	1:22	
6:16	1:34	2:24	2:16	2:09	2:03	1:58	1:54	1:51	1:48	1:45	1:42	1:40	1:38	1:36	1:34	1:32	1:31	1:29	1:28	1:27	1:25	1:24	
6:24	1:36	2:27	2:18	2:12	2:06	2:01	1:57	1:53	1:50	1:47	1:44	1:42	1:40	1:38	1:36	1:34	1:33	1:31	1:30	1:28	1:27	1:26	
6:32	1:38	2:30	2:21	2:14	2:08	2:03	1:59	1:55	1:52	1:49	1:47	1:44	1:42	1:40	1:38	1:36	1:35	1:33	1:32	1:30	1:29	1:28	
6:40	1:40	2:33	2:24	2:17	2:11	2:06	2:02	1:58	1:54	1:51	1:49	1:46	1:44	1:42	1:40	1:38	1:37	1:35	1:34	1:32	1:31	1:30	
6:48	1:42	2:36	2:27	2:20	2:14	2:09	2:04	2:00	1:57	1:54	1:51	1:48	1:46	1:44	1:42	1:40	1:38	1:37	1:35	1:34	1:33	1:31	
6:56	1:44	2:39	2:30	2:22	2:16	2:11	2:07	2:03	1:59	1:56	1:53	1:51	1:48	1:46	1:44	1:42	1:40	1:39	1:37	1:36	1:34	1:33	
7:04	1:46	2:42	2:33	2:25	2:19	2:14	2:09	2:05	2:01	1:58	1:55	1:53	1:50	1:48	1:46	1:44	1:42	1:41	1:39	1:38	1:36	1:35	
7:12	1:48	2:46	2:36	2:28	2:22	2:16	2:11	2:07	2:04	2:00	1:57	1:55	1:52	1:50	1:48	1:46	1:44	1:43	1:41	1:40	1:38	1:37	
7:20	1:50	2:49	2:39	2:31	2:24	2:19	2:14	2:10	2:06	2:03	2:00	1:57	1:54	1:52	1:50	1:48	1:46	1:44	1:43	1:41	1:40	1:39	
7:28	1:52	2:52	2:42	2:33	2:27	2:21	2:16	2:12	2:08	2:05	2:02	1:59	1:56	1:54	1:52	1:50	1:48	1:46	1:45	1:43	1:42	1:40	
7:36	1:54	2:55	2:44	2:36	2:29	2:24	2:19	2:14	2:10	2:07	2:04	2:01	1:59	1:56	1:54	1:52	1:50	1:48	1:47	1:45	1:44	1:42	
7:44	1:56	2:58	2:47	2:39	2:32	2:26	2:21	2:17	2:13	2:09	2:06	2:03	2:01	1:58	1:56	1:54	1:52	1:50	1:48	1:47	1:45	1:44	
7:52	1:58	3:01	2:50	2:42	2:35	2:29	2:24	2:19	2:15	2:12	2:08	2:05	2:03	2:00	1:58	1:56	1:54	1:52	1:50	1:49	1:47	1:46	
8:00	2:00	3:04	2:53	2:44	2:37	2:31	2:26	2:21	2:17	2:14	2:10	2:08	2:05	2:02	2:00	1:58	1:56	1:54	1:52	1:51	1:49	1:48	
8:08	2:02	3:07	2:56	2:47	2:40	2:34	2:28	2:24	2:20	2:16	2:13	2:10	2:07	2:04	2:02	2:00	1:58	1:56	1:54	1:52	1:51	1:49	
8:16	2:04	3:10	2:59	2:50	2:42	2:36	2:31	2:26	2:22	2:18	2:15	2:12	2:09	2:06	2:04	2:02	2:00	1:58	1:56	1:54	1:53	1:51	
8:24	2:06	3:13	3:02	2:53	2:45	2:39	2:33	2:28	2:24	2:20	2:17	2:14	2:11	2:08	2:06	2:04	2:02	2:00	1:58	1:56	1:54	1:53	
8:32	2:08	3:16	3:05	2:55	2:48	2:41	2:36	2:31	2:27	2:23	2:19	2:16	2:13	2:10	2:08	2:06	2:04	2:02	2:00	1:58	1:56	1:55	
8:40	2:10	3:19	3:07	2:58	2:50	2:44	2:38	2:33	2:29	2:25	2:21	2:18	2:15	2:13	2:10	2:08	2:06	2:03	2:02	2:00	1:58	1:57	

Table 3. Normative splits for Target Race Rate 40 str/min.

Target 2k time at Rate:	Split	Training 500m splits at different rates																				
		10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
4:40	1:10	1:51	1:45	1:39	1:35	1:31	1:28	1:25	1:23	1:21	1:19	1:17	1:15	1:14	1:13	1:11	1:10	1:09	1:08	1:07	1:06	1:05
4:48	1:12	1:54	1:48	1:42	1:38	1:34	1:31	1:28	1:25	1:23	1:21	1:19	1:18	1:16	1:15	1:13	1:12	1:11	1:10	1:09	1:08	1:07
4:56	1:14	1:57	1:51	1:45	1:40	1:37	1:33	1:30	1:28	1:25	1:23	1:21	1:20	1:18	1:17	1:15	1:14	1:13	1:12	1:11	1:10	1:09
5:04	1:16	2:01	1:54	1:48	1:43	1:39	1:36	1:33	1:30	1:28	1:26	1:24	1:22	1:20	1:19	1:17	1:16	1:15	1:14	1:13	1:12	1:11
5:12	1:18	2:04	1:57	1:51	1:46	1:42	1:38	1:35	1:32	1:30	1:28	1:26	1:24	1:22	1:21	1:19	1:18	1:17	1:16	1:14	1:13	1:12
5:20	1:20	2:07	2:00	1:54	1:49	1:44	1:41	1:38	1:35	1:32	1:30	1:28	1:26	1:24	1:23	1:21	1:20	1:19	1:17	1:16	1:15	1:14
5:28	1:22	2:10	2:02	1:56	1:51	1:47	1:43	1:40	1:37	1:35	1:32	1:30	1:28	1:27	1:25	1:23	1:22	1:21	1:19	1:18	1:17	1:16
5:36	1:24	2:13	2:05	1:59	1:54	1:50	1:46	1:43	1:40	1:37	1:35	1:32	1:30	1:29	1:27	1:25	1:24	1:23	1:21	1:20	1:19	1:18
5:44	1:26	2:17	2:08	2:02	1:57	1:52	1:48	1:45	1:42	1:39	1:37	1:35	1:33	1:31	1:29	1:27	1:26	1:25	1:23	1:22	1:21	1:20
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