**Facts. Did you know that...**

- Handle velocity has a strong positive correlation ($r=0.88$) with boat speed. Below are scatter graph and regression lines of maximal handle velocity $V_{h,max}$ relative to average boat speed $V_{b.aver}$ in sweep and sculling boats:

![Graph showing correlation between handle velocity and boat speed](image)

Equations of the regressions are:

- For sweep rowing, $V_{h,max} = 0.32 V_{b.aver} + 0.87$.
- For sculling, $V_{h.max} = 0.36 V_{b.aver} + 0.75$.

It is interesting that the gain $0.32-0.36$ in these equations should be equal to the gearing ratio (inboard to outboard ratio) and an offset $0.87-0.75$ should be equal to velocity of the blade slippage relative to the water. However, they differ because of the following factors: boat velocity at the time of $V_{h,max}$ is lower than average; centers of force at the blade and/or handle differ from the middle points; blade slippage is different at different boat speeds (and force at the blade).

- Maximal seat velocity has moderate correlation ($r=0.61$) with $V_{b.aver}$. Therefore, it correlates also with $V_{h.max}$ ($r=0.65$). On average, max. seat velocity equals half of max. handle velocity and a quarter of average boat speed.

**Ideas. What if...**

- You use quite a simple device for testing and training maximal legs speed? The device consists of a seat and slides mounted on a slope of a variable angle. The slope has a foot-stretcher. It is also possible to put another foot-stretcher shaped carriage on the slides to support the rower’s heels.

![Diagram of device](image)

The distance of free travel $L$ (m) is proportional to the slope angle $A$ and the seat speed (in fact, a speed of rower’s center of mass) at the take off (assuming zero friction in the seat):

<table>
<thead>
<tr>
<th>Slope Angle</th>
<th>6°</th>
<th>8°</th>
<th>10°</th>
<th>12°</th>
<th>14°</th>
<th>16°</th>
<th>18°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seat Speed at take off (m/s)</td>
<td>0.21</td>
<td>0.37</td>
<td>0.58</td>
<td>0.84</td>
<td>1.15</td>
<td>1.50</td>
<td>1.89</td>
</tr>
</tbody>
</table>

You can mount a straw or a door-bell button on the slope to check the desired distance. Angle $A$ and the seat speed also affect the stroke rate (str/min) (assuming 0.5m legs drive):

<table>
<thead>
<tr>
<th>Slope Angle</th>
<th>6°</th>
<th>8°</th>
<th>10°</th>
<th>12°</th>
<th>14°</th>
<th>16°</th>
<th>18°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seat Speed at take off (str/min)</td>
<td>20</td>
<td>19</td>
<td>18</td>
<td>16</td>
<td>15</td>
<td>14</td>
<td>13</td>
</tr>
</tbody>
</table>

You can emphasize legs power production by adding extra weights on the slide, which needs a back support in this case. It is important to accelerate legs quickly after the catch and achieve the maximal speed at 15-25cm of the drive. Therefore, it makes sense to limit legs drive to a half by, say, putting a spring link between the seat and heels (or an extra supporting carriage).

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