Agreement between repeated evaluations of gait quality in Franches-Montagnes stallions

Annik Imogen Gmel, SNSF

International Workshop on Linear Profiling in the Warmblood Horse

www.harasnational.ch

Judgement and linear description in the FM

- Linear description was introduced in the FM shortly after the ZVCH (Swiss Warmblood) in 1992
- Judgement based on whether it corresponds to the breeding goals (good/bad)
  - Scale 1 → 9
  - Grades for type, conformation and gaits
- Linear description : where the animal is situated on the biological range of the breed (less/more)
  - Scale 1 → 9
  - Linear description (39 traits)
Gait quality in dressage – FEI definition

“the freedom and regularity of the paces; the harmony, lightness and ease of the movements; the lightness of the forehand and the engagement of the hindquarters, originating from a lively impulsion”

https://inside.fei.org/fei/regulations/dressage

LD criteria in Warmblood breeds

- Energy (hurried – slow)
- Rhythm (even – uneven)
- Cadence (even – uneven)
- Impulsion (weak – powerful)
- Balance (balanced – unbalanced)
- Correctness (winging – paddling)
- Elasticity (elastic – inelastic)
- Foreleg activity (shoulder-free – short)
- Suppleness (supple – stiff)
- Carriage (on forehand – carrying)
- Hind leg activity (active – inactive)
- Direction (uphill – downhill)
- Hind leg position (under the body – behind the body)
- Stride length (long – short)
- Energetic stride (lacks power – powerful)
Assessed gait criteria in the FM

- Judgement: one score for gait quality overall
- Linear description:
  - Walk: step length (short – long)
  - Trot: step length (short – long)
  - Trot: Impulsion (weak – powerful)
  - Trot: Suppleness (stiff – elastic)
  - Correctness of gaits (plaiting – dishing)

Previous knowledge – Heritability, *phenotypic* and *genotypic* correlation on 15’905 FM horse 1994-2013

<table>
<thead>
<tr>
<th></th>
<th>Gait score</th>
<th>Walk step length</th>
<th>Trot step length</th>
<th>Trot impulsion</th>
<th>Trot suppleness</th>
<th>Correctness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gait score</td>
<td>0.35</td>
<td>0.74</td>
<td>0.99</td>
<td></td>
<td>0.98</td>
<td>0.31</td>
</tr>
<tr>
<td>Walk step length</td>
<td>0.49</td>
<td>0.17</td>
<td>0.7</td>
<td>0.69</td>
<td>0.66</td>
<td>0.13</td>
</tr>
<tr>
<td>Trot step length</td>
<td>0.84</td>
<td>0.45</td>
<td>0.31</td>
<td>0.99</td>
<td>0.98</td>
<td>0.27</td>
</tr>
<tr>
<td>Trot impulsion</td>
<td>0.82</td>
<td>0.41</td>
<td>0.80</td>
<td>0.29</td>
<td>0.98</td>
<td>0.29</td>
</tr>
<tr>
<td>Trot suppleness</td>
<td>0.38</td>
<td>0.73</td>
<td>0.76</td>
<td>0.28</td>
<td>0.29</td>
<td></td>
</tr>
<tr>
<td>Correctness</td>
<td>0.04</td>
<td>0.02</td>
<td>0.04</td>
<td>0.03</td>
<td>0.04</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Very high correlation for the three trot traits and gait score
Assessed gait criteria in the FM

- Judgement: one score for gait quality overall
- Linear description:
  - Walk: step length (short – long)
  - Trot: step length (short – long)
  - Trot: Impulsion (weak – powerful)
  - Trot: Suppleness (stiff – elastic)
  - Correctness of gaits (plaiting – dishing)
- Additional judgement traits for both gaits
  - Step length (amplitude)
  - Overtracking
  - Activity
  - Suppleness
  - Regularity

Study set up

- 7 judges
- 24 FM stallions
- 2 situations
  - Traditional judgement
  - Video evaluations
Heat map traditional judgement

- Two categories:
  - Walk
  - Trot
- Without correctness of gaits
- Correlations between 0.16 to 0.89

Heat map video evaluation

- Three categories:
  - Walk
  - Trot
  - Correctness of gaits
- Correlations ranging from 0.09 to 0.84
<table>
<thead>
<tr>
<th>Trait</th>
<th>Traditional</th>
<th>Video</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fleiss Kappa</td>
<td>ICC</td>
</tr>
<tr>
<td>Walk step length</td>
<td>0.157</td>
<td>0.480</td>
</tr>
<tr>
<td>Walk overtracking</td>
<td>0.094</td>
<td>0.400</td>
</tr>
<tr>
<td>Walk suppleness</td>
<td>0.073</td>
<td>0.424</td>
</tr>
<tr>
<td>Walk regularity</td>
<td>0.137</td>
<td>0.386</td>
</tr>
<tr>
<td>Walk activity</td>
<td>0.089</td>
<td>0.367</td>
</tr>
<tr>
<td>Walk step length LD</td>
<td>0.132</td>
<td>0.351</td>
</tr>
<tr>
<td>Trot step length</td>
<td>0.121</td>
<td>0.432</td>
</tr>
<tr>
<td>Trot overtracking</td>
<td>0.104</td>
<td>0.352</td>
</tr>
<tr>
<td>Trot activity</td>
<td>0.043</td>
<td>0.280</td>
</tr>
<tr>
<td>Trot regularity</td>
<td>0.111</td>
<td>0.274</td>
</tr>
<tr>
<td>Trot suppleness</td>
<td>0.085</td>
<td>0.395</td>
</tr>
<tr>
<td>Trot step length LD</td>
<td>0.148</td>
<td>0.425</td>
</tr>
<tr>
<td>Trot impulsion LD</td>
<td>0.057</td>
<td>0.344</td>
</tr>
<tr>
<td>Trot suppleness LD</td>
<td>0.093</td>
<td>0.437</td>
</tr>
<tr>
<td>Correctness of gaits</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Use of the scale? - rescaling
Correlations traditional setting

No relevant difference when normalising

Original data

Rescaled data

Correlations video evaluation

Worse outcome when normalising

Original data

Rescaled data
Preliminary conclusions

- Inclusion of more criteria not helpful if they are not properly described
  - For now, all walk traits correlate and all trot traits correlate
    - One walk score and one trot score would be enough

- Statistic calibration does not help if judges do not agree on trait

- What is a “good” gait quality?

Thank for your attention!

Questions are welcome!