animals

Supplementary Materials: Effects of Different Stroking Styles on Behaviour and Cardiac Parameters in Heifers

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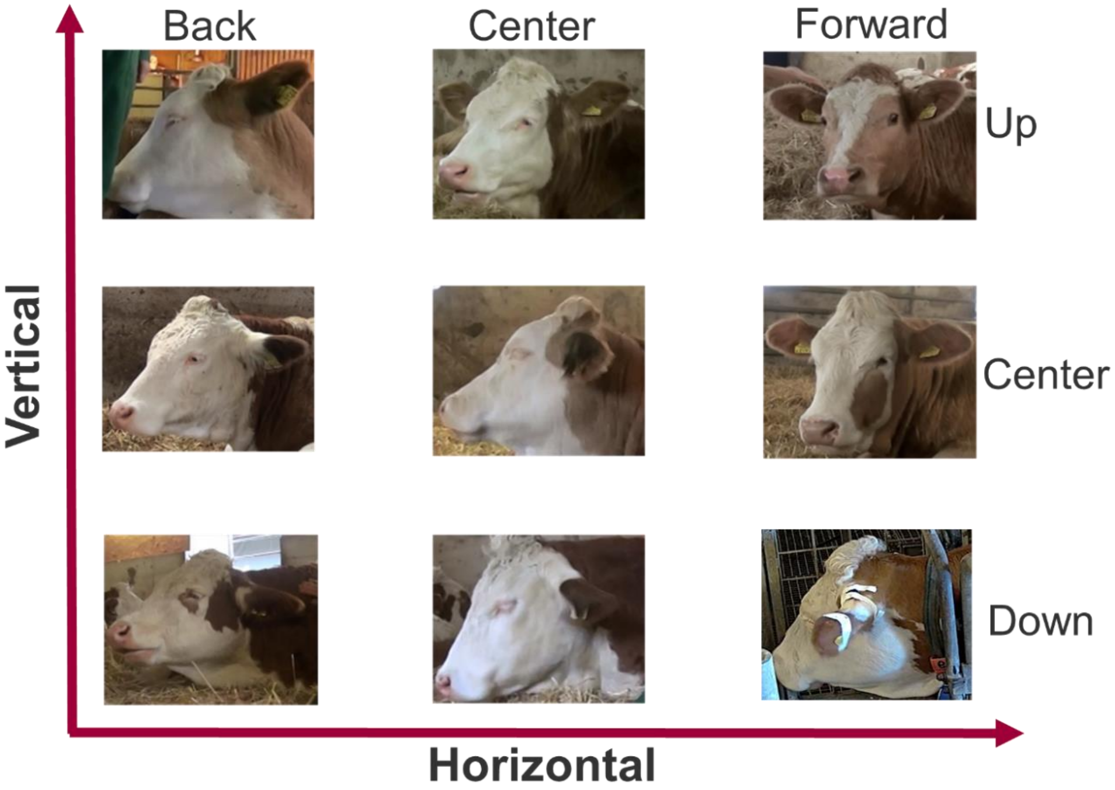

Figure S1. Example photographs of ear positions. The ear postures are described relative to the vertical axis, an imaginary line through the poll and the caudo-ventral edge of the mandible angle, and the horizontal axis, an imaginary line between the bases of the ears. “Back” means the ear is pointing towards the back of the head, “forward” refers to the rostral end of the head, “up” describes the ear pointing towards the dorsal and “down” towards the ventral part of the head. The example photograph for “forward down” was taken in another experiment because the position did not occur in our study.

(a) **(b)**

Figure S2. Example photographs of ear positions with lines indicating (**a**) the vertical axis (yellow, through the poll and the caudo-ventral edge of the mandible angle) and (**b**) the horizontal axis (red, between the bases of the ears).

Table S1. Full and reduced models for the different behaviours of the heifers (*n* = 28): comparison between the different stroking styles over the three phases. Statistically significant results appear in bold. CL: confidence limits. Statistics: GLMMs.

Full model *neck stretching*

Part	**Effects**	**Coefficients**	**SE**	**CL_{lower}**	**CL_{upper}**	**χ^2**	**df**	***p***
Mean	(Intercept)	-3.270	0.152	-3.599	-3.012			- (1)
	Treatment(2)	0.280	0.206	-0.148	0.687			-
	Phase (STR)(3)	0.949	0.178	0.626	1.297			-
	Phase (POST)(3)	-0.043	0.153	-0.344	0.26			-
	Test(2)	0.005	0.043	-0.082	0.095	0.013	1	0.910
	Treatment:Phase(4)					1.311	2	0.519
	Treatment(2) × Phase (STR)(3)	-0.214	0.220	-0.654	0.244			-
	Treatment(2) × Phase (POST)(3)	0.011	0.218	-0.401	0.469			-
Precision	(Intercept)	1.852	0.127	1.646	2.175			-
	Treatment(2)	**-0.394**	**0.171**	-0.756	-0.04	**5.258**	**1**	**0.022**

Reduced model *neck stretching* without insignificant treatment×phase interaction

Part	**Effects**	**Coefficients**	**SE**	**CL_{lower}**	**CL_{upper}**	**χ^2**	**df**	***p***
Mean	(Intercept)	-3.223	0.135	-3.377	-2.934			-
	Treatment(2)	0.178	0.148	-0.108	0.464	1.446	1	0.229
	Phase (STR)(3)	0.848	0.147	0.569	1.127	**27.527**	**2**	**< 0.001**
	Phase (POST)(3)	-0.037	0.109	-0.250	0.177			-
	Test(2)	0.008	0.043	-0.077	0.099	0.031	1	0.861
Precision	(Intercept)	1.831	0.125	1.634	2.119			-
	Treatment(2)	**-0.349**	**0.167**	-0.663	-0.014	**4.345**	**1**	**0.037**

Full model *contact*(5)

Part	**Effects**	**Coefficients**	**SE**	**CL_{lower}**	**CL_{upper}**	**χ^2 or z**	**df**	***p***
Mean	(Intercept)	-2.937	0.186	-3.267	-2.695			-
	Treatment(2)	-0.730	0.254	-1.100	-0.341	-2.873		0.004
	Phase (STR)(3)	0.383	0.197	0.100	0.712	1.947		0.052

	Phase (POST)(3)	0.084	0.197	-0.210	0.390	0.429		0.668
	Test(2)	-0.061	0.057	-0.145	0.024	-1.062		0.288
	Treatment(2) × Phase (STR)(3)	0.054	0.272	-0.382	0.479	0.197		0.844
	Treatment(2) × Phase (POST)(3)	-0.046	0.273	-0.460	0.359	-0.169		0.865
Precision	(Intercept)	1.591	0.120	1.418	1.903			-
	Treatment(2)	**0.833**	**0.172**	0.504	1.198	**4.851**	**1**	**< 0.001**
Reduced model *contact* without insignificant treatment×phase interaction(5)								
Part	**Effects**	**Coefficients**	**SE**	**CL_{lower}**	**CL_{upper}**	**χ^2 or z**	**df**	***p***
Mean	(Intercept)	-2.939	0.164	-3.549	-3.129			-
	Treatment(2)	-0.723	0.190	-1.004	-0.418	-3.805		< 0.001
	Phase (STR)(3)	0.410	0.137	0.204	0.637	2.996		**0.003**
	Phase (POST)(3)	0.060	0.136	-0.145	0.285	0.441		0.66
	Test(2)	-0.060	0.057	-0.147	0.028	-1.055		0.292
Precision	(Intercept)	1.593	0.120	1.401	1.895			-
	Treatment(2)	**0.826**	**0.171**	0.483	1.158	**4.851**	**1**	**< 0.001**
Full model *eyes closed*								
Part	**Effects**	**Coefficients**	**SE**	**CL_{lower}**	**CL_{upper}**	**χ^2**	**df**	***p***
Mean	(Intercept)	-1.162	0.167	-1.506	-0.832			-
	Treatment(2)	0.296	0.205	-0.124	0.713			-
	Phase (STR)(3)	0.073	0.182	-0.279	0.434			-
	Phase (POST)(3)	0.087	0.176	-0.247	0.443			-
	Test(2)	0.102	0.084	-0.064	0.279	1.446	1	0.229
	Treatment:Phase(4)					2.612	2	0.270
	Treatment(2) × Phase (STR)(3)	-0.388	0.257	-0.931	0.122			-
	Treatment(2) × Phase (POST)(3)	-0.062	0.251	-0.576	0.461			-
Precision	(Intercept)	0.239	0.112	0.071	0.446			-
	Treatment(2)	-0.137	0.128	-0.381	0.120	1.146	1	0.284
Full model *back up*								
Part	**Effects**	**Coefficients**	**SE**	**CL_{lower}**	**CL_{upper}**	**χ^2**	**df**	***p***
Mean	(Intercept)	0.191	0.178	-0.196	0.514			-
	Treatment(2)	0.181	0.190	-0.191	0.559			-
	Phase (STR)(3)	0.241	0.161	-0.086	0.549			-
	Phase (POST)(3)	0.070	0.151	-0.220	0.363			-
	Test(2)	-0.010	0.086	-0.187	0.154	0.014	1	0.905
	Treatment:Phase(4)					**30.100**	**2**	**<0.001**
	Treatment(2) × Phase (STR)(3)	1.167	0.233	0.693	1.578			-
	Treatment(2) × Phase (POST)(3)	0.079	0.219	-0.356	0.527			-
Precision	(Intercept)	1.125	0.115	0.916	1.314			-
	Treatment(2)	-0.149	0.139	-0.395	0.112	1.166	1	0.280
Full model *back centre*								
Part	**Effects**	**Coefficients**	**SE**	**CL_{lower}**	**CL_{upper}**	**χ^2**	**df**	***p***

Mean	(Intercept)	-1.948	0.163	-2.329	-1.650			-
	Treatment(2)	0.257	0.183	-0.100	0.653			-
	Phase (STR)(3)	0.586	0.160	0.282	0.905			-
	Phase (POST)(3)	0.290	0.159	-0.013	0.632			-
	Test(2)	-0.019	0.047	-0.111	0.081	NA(6)	1	NA(6)
	Treatment:Phase(4)					**23.825**	**2**	**<0.001**
	Treatment(2) × Phase (STR)(3)	-1.057	0.230	-1.527	-0.615			-
	Treatment(2) × Phase (POST)(3)	-0.189	0.228	-0.645	0.272			-
Precision	(Intercept)	1.022	0.097	0.884	1.278			-
	Treatment(2)	-0.167	0.228	-0.445	0.110	1.538	1	0.215
Full model *centre*								
Part	**Effects**	**Coefficients**	**SE**	**CL_{lower}**	**CL_{upper}**	**χ^2**	**df**	***p***
Mean	(Intercept)	-2.101	0.138	-2.398	-1.860			-
	Treatment(2)	-0.566	0.183	-0.929	-0.219			-
	Phase (STR)(3)	-0.203	0.157	-0.510	0.108			-
	Phase (POST)(3)	-0.099	0.156	-0.414	0.219			-
	Test(2)	-0.045	0.047	-0.133	0.037	0.939	1	0.332
	Treatment:Phase(4)					2.660	2	0.264
	Treatment(2) × Phase (STR)(3)	-0.349	0.219	-0.831	0.046			-
	Treatment(2) × Phase (POST)(3)	-0.103	0.217	-0.520	0.317			-
Precision	(Intercept)	1.254	0.108	1.087	1.515			-
	Treatment(2)	**0.555**	**3.512**	0.223	0.886	**11.92**	**1**	**< 0.001**
Reduced model *centre* without insignificant treatment×phase interaction								
Part	**Effects**	**Coefficients**	**SE**	**CL_{lower}**	**CL_{upper}**	**χ^2**	**df**	***p***
Mean	(Intercept)	-2.028	0.122	-2.296	-1.818			-
	Treatment(2)	-0.701	0.141	-0.974	-0.412	23.654	1	**< 0.001**
	Phase					**12.350**	**2**	**0.002**
	Phase (STR)(3)	-0.383	0.110	-0.610	-0.160			-
	Phase (POST)(3)	-0.149	0.109	-0.367	0.056			-
	Test(2)	-0.048	0.047	-0.143	0.045	1.066	1	0.301
Precision	(Intercept)	1.253	0.108	1.087	1.518			-
	Treatment(2)	**0.536**	**0.158**	0.225	0.826	**11.192**	**1**	**< 0.001**
Full model *forward up*(5)								
Part	**Effects**	**Coefficients**	**SE**	**CL_{lower}**	**CL_{upper}**	**χ^2 or z**	**df**	***p***
Mean	(Intercept)	-2.809	0.143	-3.132	-2.567			-
	Treatment(2)	-0.091	0.197	-0.487	0.309	-0.461		0.645
	Phase (STR)(3)	-0.283	0.154	-0.585	0.054	-1.835		0.066
	Phase (POST)(3)	0.046	0.153	-0.255	0.361	0.301		0.763
	Test(2)	0.064	0.046	-0.021	0.154	1.392		0.164
	Treatment(2) × Phase (STR)(3)	-0.057	0.216	-0.517	0.372	-0.264		0.792
	Treatment(2) × Phase (POST)(3)	-0.207	0.215	-0.618	0.201	-0.962		0.336

Precision	(Intercept)	1.620	0.125	1.441	1.938			-
	Treatment(2)	0.222	0.174	-0.144	0.580	1.619		0.203
Reduced model *forward up* without insignificant treatment×phase interaction(5)								
Part	**Effects**	**Coefficients**	**SE**	**CL$_{lower}$**	**CL$_{upper}$**	**χ^2 or z**	**df**	***p***
Mean	(Intercept)	-2.763	0.128	-3.028	-2.548			-
	Treatment(2)	-0.179	0.157	-0.499	0.126	1.301		0.254
	Phase (STR)(3)	**-0.311**	**0.109**	**-0.53**	**-0.105**	**-2.852**		**0.004**
	Phase (POST)(3)	-0.059	0.108	-0.268	0.16	-0.55		0.582
	Test(2)	0.065	0.046	-0.027	0.159	1.413		0.158
Precision	(Intercept)	1.617	0.125	1.438	1.905			-
	Treatment(2)	0.223	0.174	-0.122	0.547	1.631	1	0.202
Full model *ear low*								
Part	**Effects**	**Coefficients**	**SE**	**CL$_{lower}$**	**CL$_{upper}$**	**χ^2**	**df**	***p***
Mean	(Intercept)	-2.559	0.55	-3.993	-1.624			-
	Treatment(2)	0.293	0.51	-0.832	1.45			-
	Phase (STR)(3)	2.218	0.519	1.33	3.422			-
	Phase (POST)(3)	0.938	0.471	-0.011	1.886			-
	Test(2)	-0.234	0.153	-0.596	0.068	2.41	1	0.120
	Treatment:Phase(4)					**24.324**	**2**	**< 0.001**
	Treatment(2) × Phase (STR)(3)	-3.431	0.765	-5.404	-2.013			-
	Treatment(2) × Phase (POST)(3)	-1.677	0.699	-3.181	-0.215			-
Precision(7)								-

(1) not shown because of having a very limited interpretation (2) dummy coded ('reactive' as reference category) (3) dummy coded (PRE as reference category) (4) the indicated test refers to the overall effect of the interaction between treatment and phase (5) overdispersion; SE, z- and *p*-values corrected for overdispersion (*p*-value based on Wald's z-approximation; recognizable by no df indicated) (6) no *p*-values available due to convergence problems (7) no precision part because of binomial distribution of the *ear low* model