# Supplementary Material

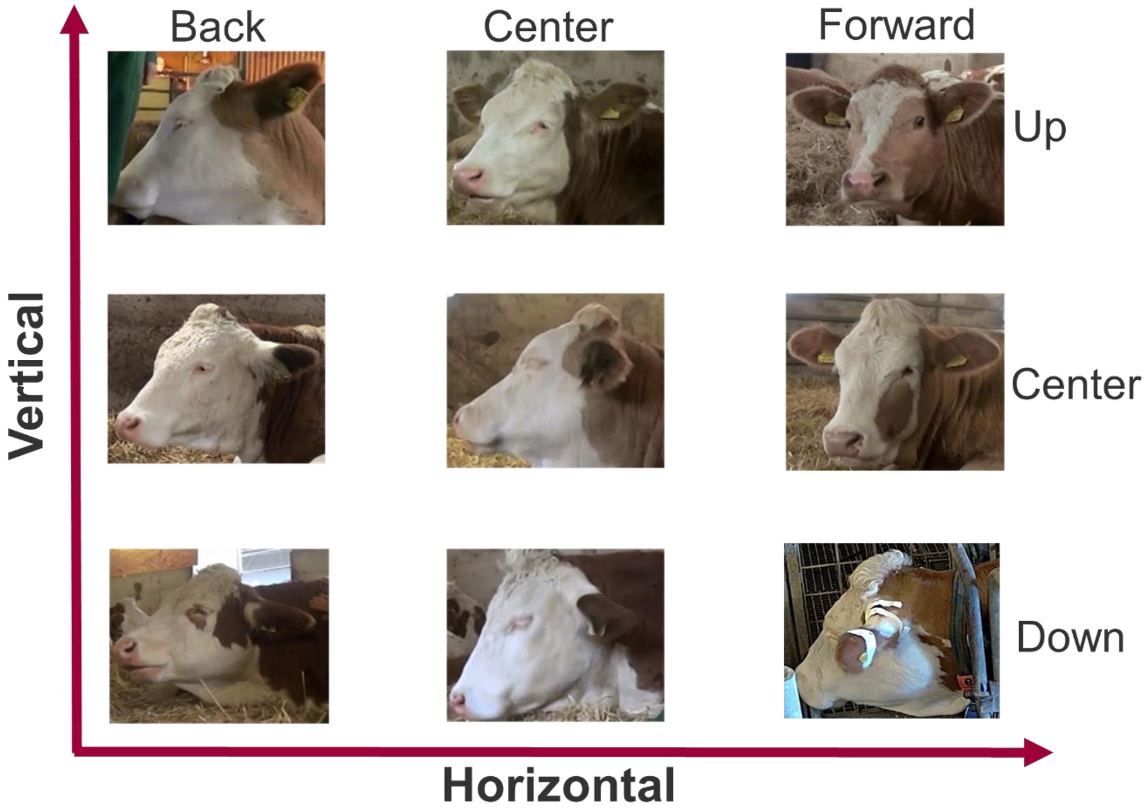
## 1 Supplementary Data

**Supplementary Data S1.** Auditory stimulus for the ‘playback’ condition containing a sample of Experimenter A talking in a gentle voice in the same way as in the ‘live’ condition, using phrases with positive content (in German) that were spoken calmly, with long low-pitched vowels and a decrease in pitch towards the end of the words or phrases.

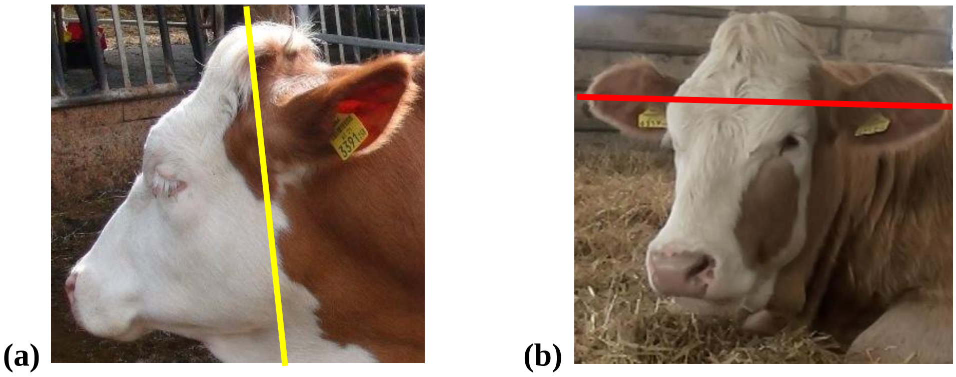
## 2 Supplementary Figures and Tables

### 2.1 Supplementary Figures

**Supplementary Figure S1.** Example photographs of ear positions (Lange et al., 2020). 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 dorsally and “down” pointing ventrally. The example photograph for “forward down” was taken in another experiment because the position did not occur in our study.



**Supplementary Figure S2.** Example photographs (Lange et al., 2020) 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).



## 2.2 Supplementary Tables

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

| **Full model *neck stretching*(1)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Part** | **Effects** | **Coefficients** | **SE** | **$\text{CL}_{\text{lower}}$** | **$\text{CL}_{\text{upper}}$** | **z** | **df** | **p** |
| Mean | (Intercept) | -4.285 | 0.219 | -4.658 | -4.008 | | | - (2) |
| | Treatment (playback)(3) | -0.491 | 0.256 | -0.864 | -0.078 | -1.923 | | 0.055 |
| | Phase (STIM)(4) | 0.698 | 0.305 | 0.296 | 1.157 | 2.287 | | 0.022 |
| | Phase (POST)(4) | -0.019 | 0.192 | -0.321 | 0.280 | -0.097 | | 0.923 |
| | Test | -0.046 | 0.068 | -0.146 | 0.051 | -0.672 | | 0.502 |
| | Treatment (playback)(3) * Phase (STIM)(4) | 0.020 | 0.264 | -0.382 | 0.419 | 0.074 | | 0.941 |
| | Treatment (playback)(3) * Phase (POST)(4) | 0.011 | 0.271 | -0.412 | 0.404 | 0.040 | | 0.968 |
| Precision | (Intercept) | 2.924 | 0.130 | 2.734 | 3.231 | | | - |
| | **Treatment (playback)(3)** | 0.674 | 0.172 | 0.327 | 1.022 | 3.912 | | **< 0.001** |
| **Reduced model *neck stretching* without insignificant treatment*phase interaction(1)** | | | | | | | | |
| **Part** | **Effects** | **Coefficients** | **SE** | **$\text{CL}_{\text{lower}}$** | **$\text{CL}_{\text{upper}}$** | **z** | **df** | **p** |
| Mean | (Intercept) | -4.291 | 0.199 | -4.577 | -4.022 | | | - |
| | Treatment (playback)(3) | -0.478 | 0.173 | -0.771 | -0.236 | -2.768 | | 0.006 |
| | **Phase (STIM)(4)** | 0.708 | 0.273 | 0.317 | 1.129 | **2.594** | | **0.009** |
| | Phase (POST)(4) | -0.013 | 0.135 | -0.223 | 0.193 | -0.097 | | 0.923 |
| | Test | -0.046 | 0.068 | -0.147 | 0.057 | -0.673 | | 0.501 |
| Precision | (Intercept) | 2.926 | 0.128 | 2.699 | 3.216 | | | - |
| | **Treatment (playback)(3)** | 0.670 | 0.165 | 0.348 | 1.001 | 16.177 | | **< 0.001** |
| **Full model *contact*(1)** | | | | | | | | |
| **Part** | **Effects** | **Coefficients** | **SE** | **$\text{CL}_{\text{lower}}$** | **$\text{CL}_{\text{upper}}$** | **z** | **df** | **p** |
| Mean | (Intercept) | -3.412 | 0.248 | -3.729 | -3.166 | | | - |
| | Treatment (playback)(3) | -0.647 | 0.346 | -1.043 | -0.273 | -1.868 | | 0.062 |
| | Phase (STIM)(4) | 0.156 | 0.254 | -0.121 | 0.45 | 0.615 | | 0.539 |
| | Phase (POST)(4) | 0.064 | 0.254 | -0.233 | 0.337 | 0.251 | | 0.802 |
| | Test | -0.038 | 0.074 | -0.121 | 0.041 | -0.518 | | 0.605 |
| | Treatment (playback) (3) * Phase (STIM)(4) | -0.039 | 0.357 | -0.465 | 0.359 | -0.110 | | 0.912 |
| | Treatment (playback)(3) * Phase (POST)(4) | 0.064 | 0.357 | -0.328 | 0.475 | 0.179 | | 0.858 |
| Precision | (Intercept) | 2.004 | 0.127 | 1.827 | 2.318 | | | - |
| | **Treatment (playback)(3)** | 0.778 | 0.180 | 0.438 | 1.117 | **4.321** | | **< 0.001** |
| **Full model *resting head*(1)** | | | | | | | | |
| **Part** | **Effects** | **Coefficients** | **SE** | **$\text{CL}_{\text{lower}}$** | **$\text{CL}_{\text{upper}}$** | **z** | **df** | **p** |
| Mean | (Intercept) | -2.669 | 0.195 | -3.018 | -2.402 | | | - |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Treatment (playback)(3) | -1.122 | 0.269 | -1.541 | -0.682 | -4.165 | | 0.000 |
| | Phase (STIM)(4) | 0.115 | 0.202 | -0.187 | 0.424 | 0.569 | | 0.569 |
| | Phase (POST)(4) | 0.105 | 0.202 | -0.192 | 0.438 | 0.520 | | 0.603 |
| | Test | -0.042 | 0.059 | -0.125 | 0.043 | -0.718 | | 0.473 |
| | Treatment (playback)(3) * Phase (STIM)(4) | 0.050 | 0.278 | -0.379 | 0.460 | 0.181 | | 0.857 |
| | Treatment (playback)(3) * Phase (POST)(4) | 0.013 | 0.278 | -0.416 | 0.422 | 0.048 | | 0.961 |
| Precision | (Intercept) | 1.046 | 0.124 | 0.857 | 1.374 | 8.433 | | - |
| | **Treatment (playback)(3)** | 1.413 | 0.178 | 1.056 | 1.803 | 7.948 | | **< 0.001** |

**Full model *flicking***

| Part | Effects | Coefficients | SE | $CL_{lower}$ | $CL_{upper}$ | $\chi^2$ | df | p |
|---|---|---|---|---|---|---|---|---|
| Mean | (Intercept) | -3.792 | 0.139 | -4.059 | -3.539 | | | - |
| | Treatment (playback)(3) | 0.296 | 0.186 | -0.068 | 0.650 | | | - |
| | Phase (STIM)(4) | -0.677 | 0.155 | -1.005 | -0.385 | | | - |
| | Phase (POST)(4) | -0.259 | 0.104 | -0.469 | -0.051 | | | - |
| | Test | 0.015 | 0.081 | -0.142 | 0.166 | 0.036 | 1 | 0.849 |
| | Treatment:Phase(5) | | | | | 0.661 | 2 | 0.718 |
| | Treatment (playback)(3) * Phase (STIM)(4) | -0.125 | 0.168 | -0.454 | 0.235 | | | - |
| | Treatment (playback)(3) * Phase (POST)(4) | -0.090 | 0.149 | -0.383 | 0.204 | | | - |
| Precision | (Intercept) | 3.978 | 0.135 | 3.754 | 4.232 | | | - |
| | Treatment (playback)(3) | -0.177 | 0.176 | -0.506 | 0.119 | 1.010 | 1 | 0.315 |

**Reduced model *flicking* without insignificant treatment*phase interaction**

| Part | Effects | Coefficients | SE | $CL_{lower}$ | $CL_{upper}$ | $\chi^2$ | df | p |
|---|---|---|---|---|---|---|---|---|
| Mean | (Intercept) | -3.720 | 0.130 | -3.960 | -3.464 | | | - |
| | Treatment (playback)(3) | 0.166 | 0.160 | -0.153 | 0.472 | 1.073 | 1 | 0.300 |
| | **Phase (STIM)(4)** | **-0.743** | **0.132** | **-1.008** | **-0.501** | **32.520** | **2** | **< 0.001** |
| | Phase (POST)(4) | -0.306 | 0.075 | -0.442 | -0.143 | | | |
| | Test | 0.018 | 0.080 | -0.145 | 0.185 | 0.050 | 1 | 0.823 |
| Precision(6) | | | | | | | | |

**Full model *eye closed***

| Part | Effects | Coefficients | SE | $CL_{lower}$ | $CL_{upper}$ | $\chi^2$ | df | p |
|---|---|---|---|---|---|---|---|---|
| Mean | (Intercept) | -2.033 | 0.153 | -2.338 | -1.758 | | | - |
| | Treatment (playback)(3) | 0.162 | 0.200 | -0.238 | 0.554 | | | - |
| | Phase (STIM)(4) | 0.039 | 0.162 | -0.299 | 0.35 | | | - |
| | Phase (POST)(4) | 0.304 | 0.165 | -0.011 | 0.614 | | | - |
| | Test | -0.012 | 0.056 | -0.120 | 0.089 | 0.045 | 1 | 0.832 |
| | Treatment:Phase(5) | | | | | 1.481 | 2 | 0.477 |
| | Treatment (playback)(3) * Phase (STIM)(4) | -0.225 | 0.231 | -0.673 | 0.220 | | | - |
| | Treatment (playback)(3) * Phase (POST)(4) | -0.260 | 0.232 | -0.695 | 0.205 | | | - |
| Precision | (Intercept) | 0.617 | 0.115 | 0.446 | 0.874 | | | - |
| | Treatment (playback)(3) | -0.003 | 0.150 | -0.313 | 0.285 | 0.000 | 1 | 0.986 |

**Full model *ear changes***

| Part | Effects | Coefficients | SE | $CL_{lower}$ | $CL_{upper}$ | $\chi^2$ | df | p |
|---|---|---|---|---|---|---|---|---|
| Mean | (Intercept) | 2.530 | 0.111 | 2.305 | 2.737 | | | - |
| | Treatment (playback)(3) | 0.015 | 0.128 | -0.251 | 0.268 | | | - |
| | Phase (STIM)(4) | -0.882 | 0.146 | -1.171 | -0.601 | | | - |
| | Phase (POST)(4) | -0.168 | 0.095 | -0.366 | 0.011 | | | - |
| | Test | -0.113 | 0.053 | -0.208 | -0.001 | 3.970 | 1 | 0.046 |
| | Treatment:Phase(5) | | | | | 0.030 | 2 | 0.985 |
| | Treatment (playback)(3) * Phase (STIM)(4) | 0.023 | 0.143 | -0.248 | 0.34 | | | - |
| | Treatment (playback)(3) * Phase (POST)(4) | 0.018 | 0.133 | -0.229 | 0.276 | | | - |
| Precision(7) | | | | | | | | - |

**Reduced model *ear changes* without insignificant treatment*phase interaction**

| Part | Effects | Coefficients | SE | $CL_{lower}$ | $CL_{upper}$ | $\chi^2$ | df | p |
|---|---|---|---|---|---|---|---|---|
| Mean | (Intercept) | 2.524 | 0.105 | 2.303 | 2.728 | | | - |
| | Treatment (playback)(3) | 0.028 | 0.104 | -0.182 | 0.240 | 0.070 | 1 | 0.791 |
| | **Phase (STIM)(4)** | -0.870 | 0.128 | -1.138 | -0.622 | 31.526 | **2** | **< 0.001** |
| | Phase (POST)(4) | -0.159 | 0.067 | -0.292 | -0.035 | | | - |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Test | -0.113 | 0.053 | -0.221 | -0.014 | 3.980 | 1 | 0.046 |
| Precision$^{(7)}$ | | | | | | | | - |

**Full model *back up***

| **Part** | **Effects** | **Coefficients** | **SE** | **$CL_{lower}$** | **$CL_{upper}$** | **$\chi^2$** | **df** | **p** |
|---|---|---|---|---|---|---|---|---|
| Mean | (Intercept) | 0.085 | 0.194 | -0.343 | 0.400 | | | - |
| | Treatment (playback)$^{(3)}$ | -0.126 | 0.201 | -0.523 | 0.262 | | | - |
| | Phase (STIM)$^{(4)}$ | 1.248 | 0.203 | 0.833 | 1.616 | | | - |
| | Phase (POST)$^{(4)}$ | 0.196 | 0.155 | -0.110 | 0.532 | | | - |
| | Test | 0.208 | 0.079 | 0.051 | 0.353 | 5.900 | 1 | 0.015 |
| | Treatment:Phase$^{(5)}$ | | | | | 0.666 | 2 | 0.717 |
| | Treatment (playback)$^{(3)}$ * Phase (STIM)$^{(4)}$ | -0.175 | 0.230 | -0.614 | 0.291 | | | - |
| | Treatment (playback)$^{(3)}$ * Phase (POST)$^{(4)}$ | -0.141 | 0.224 | -0.59 | 0.327 | | | - |
| Precision | (Intercept) | 0.992 | 0.111 | 0.791 | 1.199 | | | - |
| | Treatment (playback)$^{(3)}$ | -0.093 | 0.136 | -0.368 | 0.16 | 0.469 | 1 | 0.493 |

**Reduced model *back up* without insignificant treatment*phase interaction**

| **Part** | **Effects** | **Coefficients** | **SE** | **$CL_{lower}$** | **$CL_{upper}$** | **$\chi^2$** | **df** | **p** |
|---|---|---|---|---|---|---|---|---|
| Mean | (Intercept) | 0.135 | 0.183 | -0.270 | 0.436 | | | - |
| | Treatment (playback)$^{(3)}$ | -0.227 | 0.156 | -0.517 | 0.057 | 2.122 | 1 | 0.145 |
| | **Phase (STIM)$^{(4)}$** | 1.160 | 0.167 | 0.826 | 1.445 | **30.705** | **2** | **< 0.001** |
| | Phase (POST)$^{(4)}$ | 0.128 | 0.112 | -0.082 | 0.351 | | | - |
| | Test | 0.207 | 0.079 | 0.056 | 0.359 | 5.845 | 1 | 0.016 |
| Precision | (Intercept) | 0.980 | 0.109 | 0.778 | 1.168 | | | - |
| | Treatment (playback)$^{(3)}$ | -0.073 | 0.132 | -0.339 | 0.174 | 0.308 | 1 | 0.579 |

**Full model *back centre***

| **Part** | **Effects** | **Coefficients** | **SE** | **$CL_{lower}$** | **$CL_{upper}$** | **$\chi^2$** | **df** | **p** |
|---|---|---|---|---|---|---|---|---|
| Mean | (Intercept) | -2.049 | 0.152 | -2.368 | -1.777 | | | - |
| | Treatment (playback)$^{(3)}$ | 0.428 | 0.190 | 0.042 | 0.796 | | | - |
| | Phase (STIM)$^{(4)}$ | -0.211 | 0.155 | -0.518 | 0.098 | | | - |
| | Phase (POST)$^{(4)}$ | 0.244 | 0.154 | -0.051 | 0.571 | | | - |
| | Test | -0.100 | 0.052 | -0.196 | 0.002 | 3.776 | 1 | 0.052 |
| | Treatment:Phase$^{(5)}$ | | | | | 0.113 | 2 | 0.945 |
| | Treatment (playback)$^{(3)}$ * Phase (STIM)$^{(4)}$ | -0.008 | 0.226 | -0.458 | 0.449 | | | - |
| | Treatment (playback)$^{(3)}$ * Phase (POST)$^{(4)}$ | -0.069 | 0.225 | -0.507 | 0.377 | | | - |
| Precision | (Intercept) | 1.239 | 0.120 | 1.054 | 1.489 | | | - |
| | **Treatment (playback)$^{(3)}$** | -0.461 | 0.142 | -0.740 | -0.204 | **10.357** | **1** | **0.001** |

**Reduced model *back centre* without insignificant treatment*phase interaction**

| **Part** | **Effects** | **Coefficients** | **SE** | **$CL_{lower}$** | **$CL_{upper}$** | **$\chi^2$** | **df** | **p** |
|---|---|---|---|---|---|---|---|---|
| Mean | (Intercept) | -2.035 | 0.138 | -2.322 | -1.788 | | | - |
| | Treatment (playback)$^{(3)}$ | 0.400 | 0.137 | 0.128 | 0.664 | 8.029 | 1 | 0.052 |
| | **Phase (STIM)$^{(4)}$** | -0.214 | 0.113 | -0.460 | -0.008 | **13.500** | **2** | **0.001** |
| | Phase (POST)$^{(4)}$ | 0.212 | 0.113 | -0.013 | 0.453 | | | - |
| | Test | -0.099 | 0.052 | -0.203 | 0.001 | 3.771 | 1 | 0.052 |
| Precision | (Intercept) | 1.235 | 0.119 | 1.051 | 1.474 | | | - |
| | **Treatment (playback)$^{(3)}$** | -0.457 | 0.141 | -0.717 | -0.181 | **10.273** | **1** | **0.001** |

**Full model *forward up*$^{(1)}$**

| **Part** | **Effects** | **Coefficients** | **SE** | **$CL_{lower}$** | **$CL_{upper}$** | **z** | **df** | **p** |
|---|---|---|---|---|---|---|---|---|
| Mean | (Intercept) | -2.814 | 0.235 | -3.098 | -2.549 | | | - |
| | Treatment (playback)$^{(3)}$ | -0.009 | 0.337 | -0.392 | 0.363 | -0.027 | | 0.978 |
| | Phase (STIM)$^{(4)}$ | -0.293 | 0.257 | -0.588 | 0.001 | -1.139 | | 0.255 |
| | Phase (POST)$^{(4)}$ | -0.011 | 0.256 | -0.318 | 0.280 | -0.041 | | 0.967 |
| | Test | -0.038 | 0.074 | -0.129 | 0.051 | -0.517 | | 0.605 |
| | Treatment (playback)$^{(3)}$ * Phase (STIM)$^{(4)}$ | -0.014 | 0.366 | -0.448 | 0.415 | -0.038 | | 0.970 |
| | Treatment (playback)$^{(3)}$ * Phase (POST)$^{(4)}$ | -0.088 | 0.365 | -0.473 | 0.339 | -0.241 | | 0.810 |
| Precision | (Intercept) | 1.661 | 0.120 | 1.475 | 1.971 | | | - |
| | Treatment (playback)$^{(3)}$ | -0.015 | 0.173 | -0.350 | 0.328 | -0.087 | | 0.930 |

**Reduced model *forward up* without insignificant treatment*phase interaction$^{(1)}$**

| **Part** | **Effects** | **Coefficients** | **SE** | **$CL_{lower}$** | **$CL_{upper}$** | **z** | **df** | **p** |
|---|---|---|---|---|---|---|---|---|
| Mean | (Intercept) | -2.797 | 0.157 | -3.058 | -2.578 | | | - |
| | Treatment (playback)$^{(3)}$ | -0.044 | 0.199 | -0.368 | 0.270 | -0.219 | | 0.827 |

|  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  | **Phase (STIM)(4)** | -0.300 | 0.135 | -0.503 | -0.072 | **-2.216** |  | **0.027** |
|  | Phase (POST)(4) | -0.054 | 0.135 | -0.269 | 0.164 | -0.401 |  | 0.689 |
|  | Test | -0.038 | 0.055 | -0.123 | 0.049 | -0.700 |  | 0.484 |
| Precision | (Intercept) | 1.660 | 0.120 | 1.474 | 1.932 |  |  | - |
|  | Treatment (playback)(3) | -0.014 | 0.172 | -0.334 | 0.339 | -0.083 |  | 0.934 |
| **Full model *ear low*** |  |  |  |  |  |  |  |  |
| **Part** | **Effects** | **Coefficients** | **SE** | **CL$_{lower}$** | **CL$_{upper}$** | **$\chi^2$** | **df** | **p** |
| Mean | (Intercept) | -0.463 | 0.444 | -1.307 | 0.312 |  |  | - |
|  | Treatment (playback)(3) | 0.023 | 0.461 | -0.913 | 0.892 |  |  | - |
|  | Phase (STIM)(4) | -1.138 | 0.434 | -2.009 | -0.350 |  |  | - |
|  | Phase (POST)(4) | 0.409 | 0.407 | -0.341 | 1.144 |  |  | - |
|  | Test | -0.433 | 0.178 | -0.801 | -0.087 | 5.356 | 1 | 0.052 |
|  | Treatment:Phase(5) |  |  |  |  | 0.664 | 2 | 0.717 |
|  | Treatment (playback)(3) * Phase (STIM)(4) | 0.307 | 0.592 | -0.805 | 1.496 |  |  | - |
|  | Treatment (playback)(3) * Phase (POST)(4) | -0.172 | 0.568 | -1.247 | 0.917 |  |  | - |
| Precision(7) |  |  |  |  |  |  |  | - |
| **Reduced model *ear low* without insignificant treatment*phase interaction** |  |  |  |  |  |  |  |  |
| **Part** | **Effects** | **Coefficients** | **SE** | **CL$_{lower}$** | **CL$_{upper}$** | **$\chi^2$** | **df** | **p** |
| Mean | (Intercept) | -0.477 | 0.411 | -1.339 | 0.306 |  |  | - |
|  | Treatment (playback)(3) | 0.055 | 0.325 | -0.568 | 0.666 | 0.028 | 1 | 0.052 |
|  | **Phase (STIM)(4)** | -0.977 | 0.303 | -1.569 | -0.374 | **19.094** | **2** | **0.000** |
|  | Phase (POST)(4) | 0.321 | 0.284 | -0.213 | 0.861 |  |  | - |
|  | Test | -0.429 | 0.177 | -0.782 | -0.123 | 5.286 | 1 | 0.021 |
| Precision(7) |  |  |  |  |  |  |  | - |

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

**Supplementary Table S2.** Full models for HR(V) parameters of the heifers (n = 26): comparison between the different auditory stimuli over the three phases. Statistically significant results appear in bold. CL: confidence limits. Statistics: LMMs.

| **Full model *HR*** |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|
| **Effects** | **Coefficients** | **SE** | **CL$_{lower}$** | **CL$_{upper}$** | **$\chi^2$** | **df** | **p** |
| (Intercept) | 74.081 | 2.169 | 69.884 | 78.262 |  |  | -(1) |
| Treatment (playback)(2) | -2.364 | 2.111 | -6.543 | 2.116 |  |  | - |
| Phase (STIM)(3) | 1.541 | 0.401 | 0.815 | 2.305 |  |  | - |
| Phase (POST)(3) | -0.555 | 0.352 | -1.234 | 0.136 |  |  | - |
| Rumination | 1.694 | 0.215 | 1.262 | 2.106 | 43.959 | 1 | 0.000 |
| sin(rad.time)1 | -2.239 | 1.046 | -4.508 | 0.300 | 2.799 | 1 | 0.094 |
| cos(rad.time)1 | -8.550 | 1.102 | -11.054 | -5.957 | 11.193 | 1 | 0.001 |
| Age | -4.112 | 1.982 | -8.466 | -0.087 | 12.200 | 1 | 0.000 |
| Group | -10.326 | 3.360 | -17.398 | -2.942 | 5.786 | 1 | 0.016 |
| **Treatment:Phase(4)** |  |  |  |  | **9.917** | **2** | **0.007** |
| Treatment (playback) (2) * Phase (STIM)(3) | -0.245 | 0.448 | -1.181 | 0.600 |  |  | - |
| Treatment (playback) (2) * Phase (POST)(3) | 1.111 | 0.449 | 0.194 | 1.959 |  |  | - |
| **Full model *RMSSD*** |  |  |  |  |  |  |  |
| **Effects** | **Coefficients** | **SE** | **CL$_{lower}$** | **CL$_{upper}$** | **$\chi^2$** | **df** | **p** |
| (Intercept) | 2.808 | 0.145 | 2.512 | 3.130 |  |  | -(1) |
| Treatment (playback)(2) | -0.067 | 0.077 | -0.229 | 0.083 |  |  | - |
| Phase (STIM)(3) | -0.021 | 0.054 | -0.131 | 0.095 |  |  | - |
| Phase (POST)(3) | 0.020 | 0.056 | -0.097 | 0.132 |  |  | - |
| Heart rate | -0.349 | 0.055 | -0.471 | -0.229 | 22.351 | 1 | 0.000 |
| Rumination | 0.047 | 0.028 | -0.012 | 0.108 | 1.813 | 1 | 0.178 |
| sin(rad.time)1 | -0.032 | 0.076 | -0.210 | 0.155 | 0.112 | 1 | 0.738 |
| cos(rad.time)1 | -0.062 | 0.099 | -0.293 | 0.161 | 0.64 | 1 | 0.424 |
| Age | -0.095 | 0.129 | -0.383 | 0.182 | 0.414 | 1 | 0.520 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Group | -0.258 | 0.278 | -0.879 | 0.355 | 1.174 | 1 | 0.279 |
| Treatment:Phase(4) | | | | | 0.673 | 2 | 0.714 |
| Treatment (playback)(2) * Phase (STIM)(3) | 0.013 | 0.072 | -0.122 | 0.148 | | | - |
| Treatment (playback)(2) * Phase (POST)(3) | 0.057 | 0.073 | -0.082 | 0.209 | | | - |
| **Full model *SDNN*** | | | | | | | |
| **Effects** | **Coefficients** | **SE** | **$CL_{lower}$** | **$CL_{upper}$** | **$\chi^2$** | **df** | **p** |
| (Intercept) | 5.208 | 0.291 | 3.030 | 3.452 | | | -(1) |
| Treatment (playback)(2) | -0.046 | 0.245 | -0.212 | 0.135 | | | - |
| Phase (STIM)(3) | 0.447 | 0.208 | 0.039 | 0.335 | | | - |
| Phase (POST)(3) | 0.088 | 0.207 | -0.100 | 0.186 | | | - |
| Heart rate | -0.562 | 0.134 | -0.345 | -0.117 | 11.671 | 1 | 0.001 |
| Rumination | -0.098 | 0.087 | -0.091 | 0.034 | 1.486 | 1 | 0.223 |
| sin(rad.time)1 | -0.142 | 0.220 | -0.225 | 0.097 | 2.608 | 1 | 0.456 |
| cos(rad.time)1 | -0.501 | 0.270 | -0.426 | -0.041 | 4.173 | 1 | 0.243 |
| Age | -0.173 | 0.203 | -0.254 | 0.064 | 0.328 | 1 | 0.567 |
| Group | -0.389 | 0.442 | -0.511 | 0.185 | 1.15 | 1 | 0.284 |
| **Treatment:Phase(4)** | | | | | **9.963** | **2** | **0.007** |
| Treatment (playback)(2) * Phase (STIM)(3) | -0.466 | 0.283 | -0.346 | 0.029 | | | - |
| Treatment (playback)(2) * Phase (POST)(3) | 0.411 | 0.284 | -0.053 | 0.317 | | | - |
| **Full model *RMSSD/SDNN*** | | | | | | | |
| **Effects** | **Coefficients** | **SE** | **$CL_{lower}$** | **$CL_{upper}$** | **$\chi^2$** | **df** | **p** |
| (Intercept) | 0.821 | 0.040 | 0.737 | 0.906 | | | -(1) |
| Treatment (playback)(2) | -0.036 | 0.026 | -0.085 | 0.018 | | | - |
| Phase (STIM)(3) | -0.063 | 0.023 | -0.106 | -0.016 | | | - |
| Phase (POST)(3) | -0.005 | 0.024 | -0.053 | 0.039 | | | - |
| Heart rate | -0.093 | 0.016 | -0.126 | -0.057 | 27.486 | 1 | 0.000 |
| Rumination | 0.023 | 0.009 | 0.003 | 0.043 | 4.815 | 1 | 0.028 |
| sin(rad.time)1 | -0.006 | 0.023 | -0.055 | 0.040 | -0.01 | 1 | 1 |
| cos(rad.time)1 | 0.034 | 0.028 | -0.034 | 0.093 | 1.107 | 1 | 0.293 |
| Age | -0.048 | 0.030 | -0.118 | 0.022 | 1.699 | 1 | 0.192 |
| Group | -0.032 | 0.066 | -0.181 | 0.119 | 0.173 | 1 | 0.677 |
| **Treatment:Phase(4)** | | | | | **8.378** | **2** | **0.015** |
| Treatment (playback)(2) * Phase (STIM)(3) | 0.063 | 0.030 | 0.002 | 0.117 | | | - |
| Treatment (playback)(2) * Phase (POST)(3) | -0.022 | 0.03 | -0.083 | 0.038 | | | - |
| **Full model *HF*** | | | | | | | |
| **Effects** | **Coefficients** | **SE** | **$CL_{lower}$** | **$CL_{upper}$** | **$\chi^2$** | **df** | **p** |
| (Intercept) | 2.903 | 0.157 | 2.559 | 3.219 | | | -(1) |
| Treatment (playback)(2) | -0.007 | 0.119 | -0.241 | 0.237 | | | - |
| Phase (STIM)(3) | -0.043 | 0.114 | -0.256 | 0.187 | | | - |
| Phase (POST)(3) | 0.222 | 0.107 | 0.000 | 0.435 | | | - |
| Heart rate | -0.584 | 0.081 | -0.765 | -0.407 | 41.484 | 1 | 0.000 |
| Rumination | 0.085 | 0.044 | -0.006 | 0.177 | 2.994 | 1 | 0.084 |
| sin(rad.time)1 | 0.020 | 0.098 | -0.198 | 0.214 | 0.038 | 1 | 0.846 |
| cos(rad.time)1 | 0.328 | 0.115 | 0.064 | 0.581 | 6.801 | 1 | 0.009 |
| Age | -0.220 | 0.135 | -0.513 | 0.065 | 2.226 | 1 | 0.136 |
| Group | -0.153 | 0.315 | -0.806 | 0.576 | 0.206 | 1 | 0.650 |
| **Treatment:Phase(4)** | | | | | **7.657** | **2** | **0.022** |
| Treatment (playback)(2) * Phase (STIM)(3) | 0.070 | 0.143 | -0.220 | 0.351 | | | - |
| Treatment (playback)(2) * Phase (POST)(3) | -0.307 | 0.143 | -0.586 | -0.031 | | | - |
| **Full model *LF*** | | | | | | | |
| **Effects** | **Coefficients** | **SE** | **$CL_{lower}$** | **$CL_{upper}$** | **$\chi^2$** | **df** | **p** |
| (Intercept) | 67.999 | 3.984 | 60.143 | 76.398 | | | -(1) |
| Treatment (playback)(2) | 0.081 | 3.222 | -6.357 | 6.435 | | | - |
| Phase (STIM)(3) | -0.041 | 3.074 | -5.867 | 5.811 | | | - |
| Phase (POST)(3) | -1.584 | 3.172 | -8.046 | 4.931 | | | - |
| Heart rate | 7.639 | 1.743 | 4.001 | 11.392 | 15.572 | 1 | 0.000 |
| Rumination | 1.252 | 1.185 | -1.224 | 3.678 | 0.990 | 1 | 0.320 |
| sin(rad.time)1 | 1.013 | 2.858 | -4.777 | 6.805 | 0.180 | 1 | 0.671 |
| cos(rad.time)1 | -4.792 | 3.523 | -12.146 | 2.750 | 1.336 | 1 | 0.248 |
| Age | 0.895 | 2.997 | -5.524 | 7.294 | 0.154 | 1 | 0.695 |
| Group | 5.955 | 6.842 | -8.596 | 20.433 | 0.613 | 1 | 0.434 |
| Treatment:Phase(4) | | | | | 0.009 | 2 | 0.995 |
| Treatment (playback)(2) * Phase (STIM)(3) | -0.372 | 4.189 | -8.479 | 7.639 | | | - |
| Treatment (playback)(2) * Phase (POST)(3) | -0.072 | 4.210 | -7.890 | 8.384 | | | - |

| **Full model *LF/HF*** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Effects** | **Coefficients** | **SE** | **$\text{CL}_{\text{lower}}$** | **$\text{CL}_{\text{upper}}$** | **$\chi^2$** | **df** | **p** |
| (Intercept) | 1.204 | 0.209 | 0.747 | 1.631 | | | -(1) |
| Treatment (playback)(2) | -0.025 | 0.164 | -0.340 | 0.295 | | | - |
| Phase (STIM)(3) | 0.005 | 0.160 | -0.297 | 0.304 | | | - |
| Phase (POST)(3) | -0.270 | 0.152 | -0.567 | 0.052 | | | - |
| Heart rate | 0.703 | 0.102 | 0.475 | 0.921 | 32.913 | 1 | 0.000 |
| Rumination | -0.040 | 0.062 | -0.167 | 0.098 | 0.373 | 1 | 0.542 |
| sin(rad.time)1 | -0.028 | 0.146 | -0.327 | 0.267 | -1.902 | 1 | 1 |
| cos(rad.time)1 | -0.497 | 0.173 | -0.877 | -0.146 | 5.543 | 1 | 0.019 |
| Age | 0.033 | 0.169 | -0.347 | 0.376 | 0.030 | 1 | 0.863 |
| Group | 0.580 | 0.404 | -0.306 | 1.429 | -1.310 | 1 | 1 |
| Treatment:Phase(4) | | | | | 1.994 | 2 | 0.369 |
| Treatment (playback)(2) * Phase (STIM)(3) | -0.024 | 0.206 | -0.408 | 0.399 | | | - |
| Treatment (playback)(2) * Phase (POST)(3) | 0.337 | 0.206 | -0.068 | 0.722 | | | - |

(1) not shown because of having a very limited interpretation

(2) dummy coded (‘live’ 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