**Supplementary Methods**

Scales

The participants in the social treatment groups rated the similarity between themselves and the other person (the confederate) on a 9-point rating scale (modified from 1, 2) ranging from “1” (very much) to “9” (not at all). Specifically, similarity was measured by rating the following items: “How similar is the other person? How much do you and the other person have in common? Would you use the word “we” to describe yourself and the other person? How close and similar do you feel to the other person?”. To facilitate the interpretation of the similarity scores, the individual items were coded so that higher scores reflected higher levels of perceived similarity. Moreover, they rated the helpfulness of the other (“How helpful was the other person?”), ranging from “1” (very helpful) to “9” (not helpful at all).

Path analysis

To determine causal interactions between similarity and state anxiety, we performed a moderated mediation model, with treatment group (ingroup/outgroup) as a moderator, using the Lavaan package in R (3). We used the trial by trial SCRs to aversive sounds as the dependent variable. The anxiety level of participants as the predictor variable, the perceived similarity of the present person as the mediator variable. Individual ratings on the social support scale (4) (friends, family and significant others) and on helpfulness of the other were included as covariates. First, we established a path model, including data points from all participants of the ingroup and the outgroup treatment group, and assessed the moderating effect of treatment group (ingroup vs. outgroup treatment). Second, we performed modelling within each treatment group to characterize the path strength for each group separately.

**Supplementary Results**

Testing habituation effects

The following linear mixed model analyses tested whether the observed effects were different in the first and the second half of the experiment by including time (first/ second half of trials) as predictor.

**Table S1.** Results of the linear mixed model with treatment (alone/ingroup/outgroup), time (first/second half of trials) and their interaction terms as the predictors, trial by trial affect ratings as the dependent variable. Participants were entered as the random factor (random intercept).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | *χ2* | df | p value | B | SE |
| Treatment  | 1.77 | 2 | 0.41 |  |  |
| -ingroup |  |  |  | 0.36 | 0.28 |
| -outgroup |  |  |  | 0.15 | 0.28 |
| Time  | 1.75 | 1 | 0.19 | 0.082 | 0.062  |
| Treatment × time | 3.13 | 2 | 0.21 |  |   |
| -ingroup × time |  |  |  | -0.12 | 0.085 |
| -outgroup × time |  |  |  | 0.021 | 0.087 |

**Table S2.** Results of the linear mixed model comparing the effects of SCRs between the sound anticipation and sound presentation periods. Period (sound anticipation/presentation), treatment (alone/ingroup/outgroup), time (first/second half of trials) and their interaction terms were added as the predictors, trial by trial SCRs as the dependent variable. Participants, time and period were entered as the random factor (random intercept/slopes).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | *χ2* | df | p value | B | SE |
| Period  | 108.48 | 1 | <0.001 | 0.19 | 0.019 |
| Treatment  | 2.91 | 2 | 0.23 |  | 0.020 |
| -ingroup |  |  |  | -0.022 | 0.015 |
| -outgroup |  |  |  | -0.00072 | 0.015 |
| Time  | 10.77 | 1 | 0.001 | -0.038 | 0.013 |
| Period × treatment | 11.90 | 2 | 0.002 |  |  |
| -ingroup |  |  |  | -0.066 | 0.025 |
| -outgroup |  |  |  | -0.086 | 0.026 |
| Period × time | 13.97 | 1 | <0.001 | -0.062 | 0.017 |
| Treatment × time | 1.39 | 2 | 0.50 |  | 0.017 |
| -ingroup × time |  |  |  | 0.0074 | 0.016 |
| -outgroup × time |  |  |  | 0.019 | 0.017 |
| Period × treatment × time | 1.27 | 2 | 0.53 |  |  |
| -Period × ingroup × time |  |  |  | 0.026 | 0.023 |
| -Period × outgroup × time |  |  |  | 0.014 | 0.024 |

**Table S3.** Results of the linear mixed model on the SCRs for the sounds anticipation period. Treatment (alone/ingroup/outgroup), time (first/second half of trials) and their interaction term were added as the predictors, trial by trial SCRs as the dependent variable. Participants were entered as the random factor (random intercept).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | *χ2* | df | p-value | B | SE |
| Treatment | 3.16 | 2 | 0.21 |  |  |
| -ingroup |  |  |  | -0.022 | 0.014 |
| -outgroup |  |  |  | -0.00071 | 0.015 |
| Time | 14.81 | 1 | <0.001 | -0.039 | 0.012 |
| Treatment × time | 1.94 | 2 | 0.38 |  |  |
| -ingroup × time |  |  |  | 0.0076 | 0.014 |
| -outgroup × time |  |  |  | 0.020 | 0.014 |

**Table S4.** Results of the linear mixed model on SCRs for the sound presentation period. Treatment (alone/ingroup/outgroup), time (first/second half of trials) and their interaction term were added as the predictors, trial by trial SCRs as the dependent variable. Participants were entered as the random factor (random intercept).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | *χ2* | df | p-value | B | SE |
| Treatment | 16.14 | 2 | <0.001 |  |  |
| - ingroup |  |  |  | -0.053 | 0.014 |
| - outgroup |  |  |  | -0.047 | 0.015 |
| Time | 54.60 | 1 | <0.001 | -0.066 | 0.0090 |
| Treatment × time | 5.83 | 2 | 0.054 |  |  |
| -ingroup × time |  |  |  | 0.025 | 0.012 |
| -outgroup × time |  |  |  | 0.027 | 0.013 |

**Table S5.** Result of the linear mixed model including treatment (alone/ingroup/outgroup), time (first/second half of trials) and individual STAI state anxiety scores, STAI trait anxiety scores, ASI scores, and their interaction terms as predictors and trial-by-trial SCRs to the aversive sounds as dependent variable. Individual ratings on the social su pport scale (family, friends and significant others) were entered as covariates. Participants were entered as the random factor (random intercept).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | *χ2* | df | p-value | B | SE |
| STAI-state anxiety | 7.51  | 1 | 0.006 | 0.058 | 0.021 |
| Treatment | 20.77  | 2 | <0.001 |  |   |
| -ingroup |  |  |  | -0.097 | 0.024 |
| -outgroup |  |  |  | -0.098 | 0.025 |
| Time | 58.05  | 1 | <0.001 | -0.10 | 0.013 |
| STAI-trait anxiety  | 4.24  | 1 | 0.040 | 0.048 | 0.023 |
| ASI | 2.17  | 1 | 0.14 | -0.031 | 0.021  |
| STAI-state anxiety × treatment | 8.68  | 2 | 0.013 |  |   |
| - STAI-state anxiety × ingroup |  |  |  | -0.082 | 0.028 |
| - STAI-state anxiety × outgroup |  |  |  | -0.054 | 0.032 |
| STAI-state anxiety × time | 1.28  | 1 | 0.26 | -0.018 | 0.016 |
| Treatment × time | 4.13  | 2 | 0.13 |  |  |
| -ingroup × time |  |  |  | 0.034 | 0.018 |
| -outgroup × time |  |  |  | 0.032 | 0.019 |
| STAI-trait anxiety × treatment  | 5.73  | 2 | 0.057 | -0.072 | 0.028  |
| -STAI-trait anxiety × ingroup |  |  |  | -0.051 | 0.028 |
| - STAI-trait anxiety × outgroup |  |  |  | -0.079 | 0.036 |
| STAI-trait anxiety× time  | 3.53  | 1 | 0.060 | -0.031 | 0.017 |
| ASI × treatment  | 5.30  | 2 | 0.071 |  |  |
| - ASI × ingroup |  |  |  | 0.042 | 0.029 |
| - ASI × outgroup |  |  |  | 0.068 | 0.030 |
| ASI × time | 2.29  | 1 | 0.13 | 0.024 | 0.016  |
| STAI-state anxiety × treatment × time | 2.61  | 2 | 0.27 | -0.018 | 0.024  |
| - STAI-state anxiety ×ingroup × time |  |  |  | 0.031 | 0.021 |
| - STAI-state anxiety ×outgroup × time |  |  |  | 0.032 | 0.025 |
| STAI-trait anxiety × treatment × time | 2.93  | 2 | 0.23 | 0.029 | 0.023  |
| - STAI-trait anxiety × ingroup × time |  |  |  | 0.026 | 0.021 |
| - STAI-trait anxiety × outgroup × time |  |  |  | 0.044 | 0.027 |
| ASI × treatment × time | 2.69  | 2 | 0.26 | 0.028 | 0.025  |
| - ASI × ingroup × time |  |  |  | -0.019 | 0.022 |
| - ASI × outgroup × time |  |  |  | -0.037 | 0.023 |

**Table S6.** Result of the linear mixed model including treatment (ingroup/outgroup), time (first/second half of trials), perceived similarity and their interaction terms as predictors and trial-by-trial SCRs to the aversive sounds as dependent variable. Individual ratings on the social support scale (family, friends and significant others) and on the helpfulness of the present person were entered as covariates, participants were entered as the random factor (random intercept).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | *χ2* | df | p-value | B | SE |
| Perceived similarity | 11.39  | 1 | <0.001 | 0.051 | 0.015  |
| Treatment | 0.57 | 1 | 0.45 | 0.017 | 0.022  |
| Time | 29.13  | 1 | <0.001 | -0.060 | 0.011  |
| Perceived similarity × treatment | 1.14  | 1 | 0.29 | -0.024 | 0.023  |
| Perceived similarity × time | 9.11  | 1 | 0.003 | -0.031 | 0.010  |
| Treatment × time | 1.10  | 1 | 0.29 | -0.017 | 0.016  |
| Perceived similarity × treatment × time | 0.023  | 1 | 0.88 | 0.025 | 0.017  |

Taken together, all analyses on SCRs revealed a main effect of time, all *χ2*(1)> 10, *p* ≤ 0.001, indicating bigger SCRs in the first half than in the second half of trials. For the sound anticipation and presentation periods, the interaction of treatment × time was not significant, all *χ2*(2)< 5.90, *p* > 0.001, indicating similar effect between first half and second half of trials both for three groups.



**Figure S1.** Grand-averaged SCRs to aversive and neutral sounds during sound presentation period. The shaded area depicts the time window that was used for the statistical analyses.

**References**

1. Hein G, Silani G, Preuschoff K, Batson CD, Singer T. Neural responses to ingroup and outgroup members' suffering predict individual differences in costly helping. Neuron. 2010;68(1):149-60.

2. Hein G, Engelmann JB, Vollberg MC, Tobler PN. How learning shapes the empathic brain. Proceedings of the National Academy of Sciences. 2016;113(1):80-5.

3. Rosseel Y. lavaan : An R Package for Structural Equation Modeling. Journal of Statistical Software. 2012;48(2):1-36.

4. Zimet GD, Dahlem NW, Zimet SG, Farley GK. The multidimensional scale of perceived social support. Journal of personality assessment. 1988;52(1):30-41.