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Supplementary Information for

Intergroup Social Influence on Emotion Processing in the Brain

Lynda C. Lin[a*], Yang Qu[b], Eva H. Telzer[c*]

[a]University of Illinois at Urbana-Champaign [b]Northwestern University [c]University of North Carolina at Chapel Hill

*Corresponding authors:

Lynda C. Lin
llin90@illinois.edu

Eva H. Telzer
ehtelzer@unc.edu

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Supporting Information

SI Task Manipulation Check

We first did a manipulation check to see if participants moved more in influence (vs. no influence) trials (focusing on moderate trials as is the focus of the paper). We found that participants changed their behavior to a greater extent in influence vs. no-influence trials. More specifically, subjects' absolute difference between their final and initial ratings was higher when they were presented with ingroup feedback ($M = 1.93$) than when they were not presented with any feedback ($M = 1.64$), $t(44) = 3.76$, $p < .001$. The magnitude of their change in ratings was also higher when they were presented with outgroup feedback ($M = 1.85$) than when they were not presented with any feedback, $t(44) = 2.73$, $p < .01$.

SI Ingroup vs. Outgroup Behavioral and Neural Results for Each Cultural Group Separately

We ran additional post-hoc tests to examine whether the ingroup vs. outgroup effects were present for each cultural group separately. At the behavioral level, we performed one-tailed paired sample t-tests to investigate whether participants shifted their emotion ratings more in the direction of the ingroup (vs. outgroup) (focusing on moderate trials as is the focus of the paper). Results revealed that Chinese subjects were marginally more influenced by ingroup ($M = 1.24$) than outgroup ($M = 1.02$) feedback, $t(22) = 1.53$, $p = .07$. Similarly, American subjects were marginally more influenced by ingroup (M=1.14) than outgroup ($M = 0.93$) feedback, $t(21) = 1.63$, $p = .06$. Given the low sample size for each group (22 for American and 23 for Chinese), we had reduced power to detect differences between ingroup and outgroup influence when looking at each cultural group separately. Additional analyses looking at the effect size revealed similar effect sizes for Chinese (*d* = 0.37) and American (*d* = 0.32) participants, which were comparable to the effect size for the sample as a whole (*d* = 0.34).

At the neural level, we performed one-sample t-tests examining the contrast [Ingroup-Outgroup] for each cultural group separately. At our post-hoc threshold of $p < .05$, the neural regions that showed increased activation when aligning emotions with the ingroup (vs. outgroup) for each cultural group separately were similar as the pattern of activation for the sample as a whole. More specifically, both Chinese (https://neurovault.org/collections/RHJBYKGH/images/64803/) and American (https://neurovault.org/collections/RHJBYKGH/images/64804/) participants showed greater recruitment of the dmPFC, mPFC, vmPFC, left amygdala, left VS, bilateral insula, left temporal pole, right pSTS, and bilateral vlPFC when shifting their emotional ratings to go towards the ingroup (vs. outgroup).

SI Main Effect of Social Influence at the Neural Level

In order to examine the main effect of social influence as has been the focus of prior papers, we conducted a whole-brain one-sample t-test to analyze the contrast [Ingroup+Outgroup – NoFeedback] (e.g. Influence – No Influence). At our voxel-wise threshold of $p < .005$ in combination with a minimum cluster size of 231 voxels, we did not find any differences in neural activation for influence (vs. no influence) trials (https://neurovault.org/collections/RHJBYKGH/images/64794/). There are various reasons why we may have failed to find results similar to previous studies (1–6) that could stem from differences in the nature of our task. For instance, our task focused on social influence on emotions (vs. evaluation or perception as most of the previous studies) and the task design did not include the initial ratings in the same session as the final ratings as has been done in most neuroscience studies on social conformity. Moreover, our intergroup manipulation may have been so salient that it washed out effects when collapsing across conditions.

SI Behavioral Conformity to Ingroup vs. Outgroup Members (All Trials)

Behavioral conformity results using all trials (moderate and extreme) indicated that participants showed higher influence scores for the ingroup (M = 1.26, SD = 0.56) than the outgroup (M = 1.13, SD = 0.65) but this difference was not significant, $t(44) = 1.31$, $p = .20$).

SI fMRI "Social Influence" Task

Before the scan, participants were told that they would be rating pictures just like in their first session. They were informed that we had obtained ratings from other universities in the United States and China with whom we were collaborating and that for many of the pictures, they would see how students from those universities rated the images (Fig. 1). An American flag next to a rating indicated the average ratings of all of the American students and a Chinese flag next to a rating indicated the average ratings of all of the Chinese students (ratings displayed from these groups henceforth referred to as "group ratings"). For the American participants, group ratings from the American students constituted the ingroup and those from the Chinese students constituted the outgroup. For the Chinese participants, group ratings from the Chinese students constituted the ingroup and ratings from the American students constituted the outgroup. On some trials, a gray flag with a # sign (rather than numerical rating), was presented, which indicated they would not see how other people rated those images. In reality, group ratings were experimentally manipulated based on the participants' initial ratings during the behavioral session. From the initial 100 images they rated in the first session, we chose 60 images and showed them Ingroup, Outgroup, or No Feedback ratings that were higher (+2, +3, +4) and lower (-2, -3, -4) than their initial scores with an equal distribution of higher/lower scores and Ingroup/Outgroup/No Feedback ratings. In total, each participant saw 24 Ingroup, 24 Outgroup and 12 No Rating group ratings. Participants for whom we could not create this distribution of ratings based on their initial session (n=7), which usually occurred because they predominantly rated on the higher or lower end of scales, were not invited for the fMRI scan and do not constitute the 45 participants described in the sample.

SI Initial Ratings

The average baseline score across all trials was 6.24 (*SD* = 2.07). In order to examine whether there were differences in participants' baseline ratings between ingroup and outgroup image targets, we performed paired samples t-test to compare the initial ratings for each image target group. We found no differences in the baseline ratings for ingroup ($M = 6.23$, $SD = 0.95$) vs. outgroup ($M = 6.24$, $SD = 1.10$) image targets, $t(44) = 0.11$, $p = .92$.

We also performed a two-sample t-test to examine whether baseline ratings differed between American and Chinese participants. We found marginal differences in the baseline ratings between American ($M = 6.49$, $SD = 1.06$) and Chinese ($M = 5.99$, $SD = 0.74$) participants, $t(43) = 1.85$, $p = .07$.

SI PM Calculation for No-Influence Trials

For trials where participants did not see ratings from others (no group rating present), the PM was calculated based on the change from final to initial rating. For these trials, if the participant moved by 2 points or more in either direction, this was coded as a 2, if they moved by 1 point, this was coded as a 1, and if they did not move, this was coded as a 0.

SI Moderate vs. Extreme Trials

In order to compare whether participants moved more in moderate (vs. extreme) trials, we excluded trials where participants moved more than 4 points, given this was the highest group feedback influence score with which we provided them and to make moderate and extreme trials comparable. In addition, given that usually in an extreme trial (initial rating of 1, 2, 9, 10), the participant tends to move towards the influence (rather than away as is more possible for moderate trials), most extreme trials will have positive influence scores (while moderate trials will have positive and negative influence scores since they have more room to move away from the influence compared to extreme trials). Thus, we compared the absolute change in behavior (final-initial) between moderate and extreme trials to look at the overall movement for each type (moderate vs. extreme) of trial. We found that participants' absolute change in behavior was greater for moderate (M = 1.70) vs. extreme (M = 1.50) trials, $t(43) = 2.14$, $p < .05$.

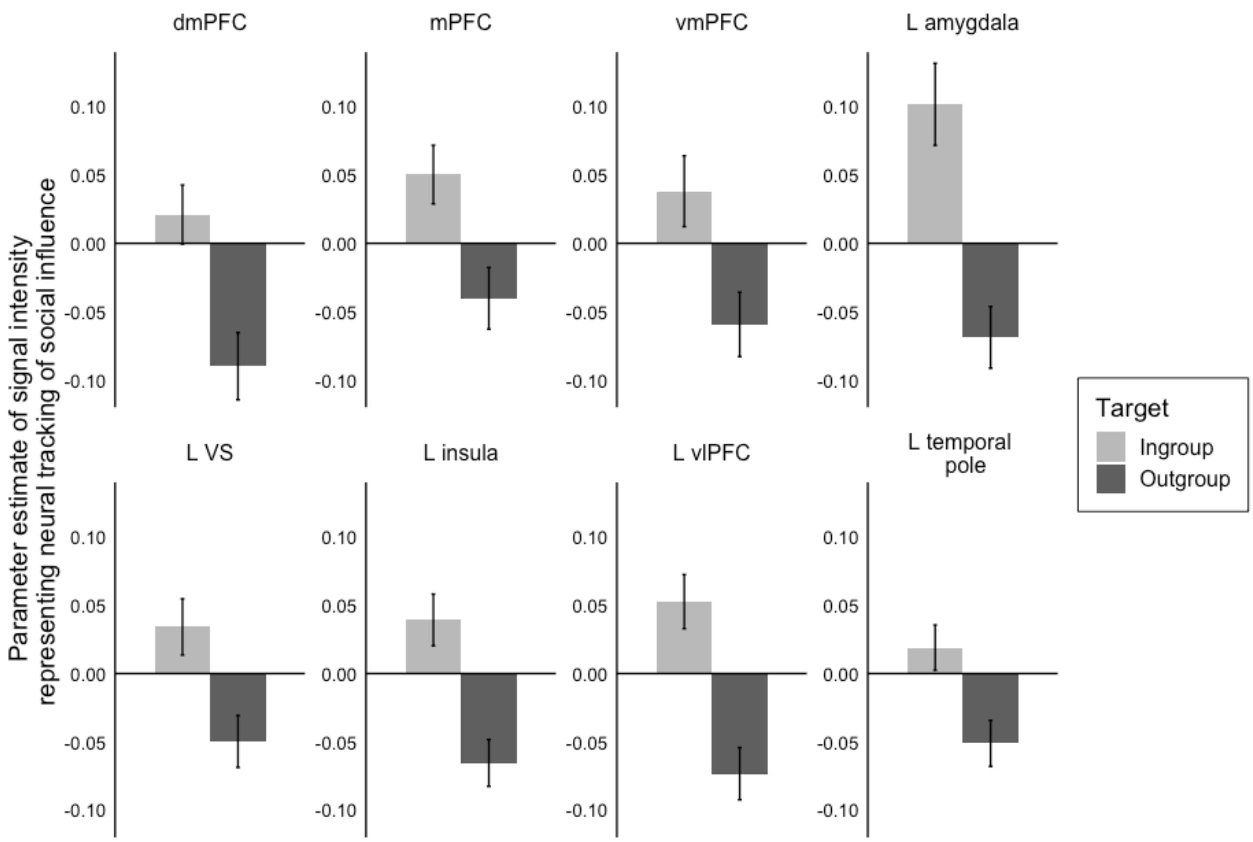

Fig. S1. Extracted parameter estimates from Fig. 3. Parameter estimates of signal intensity were extracted from spheres with 6mm radius around the peak voxels shown in Table S1. L and R refer to the left or right hemisphere. Error bars represent standard error of the mean (SEM).

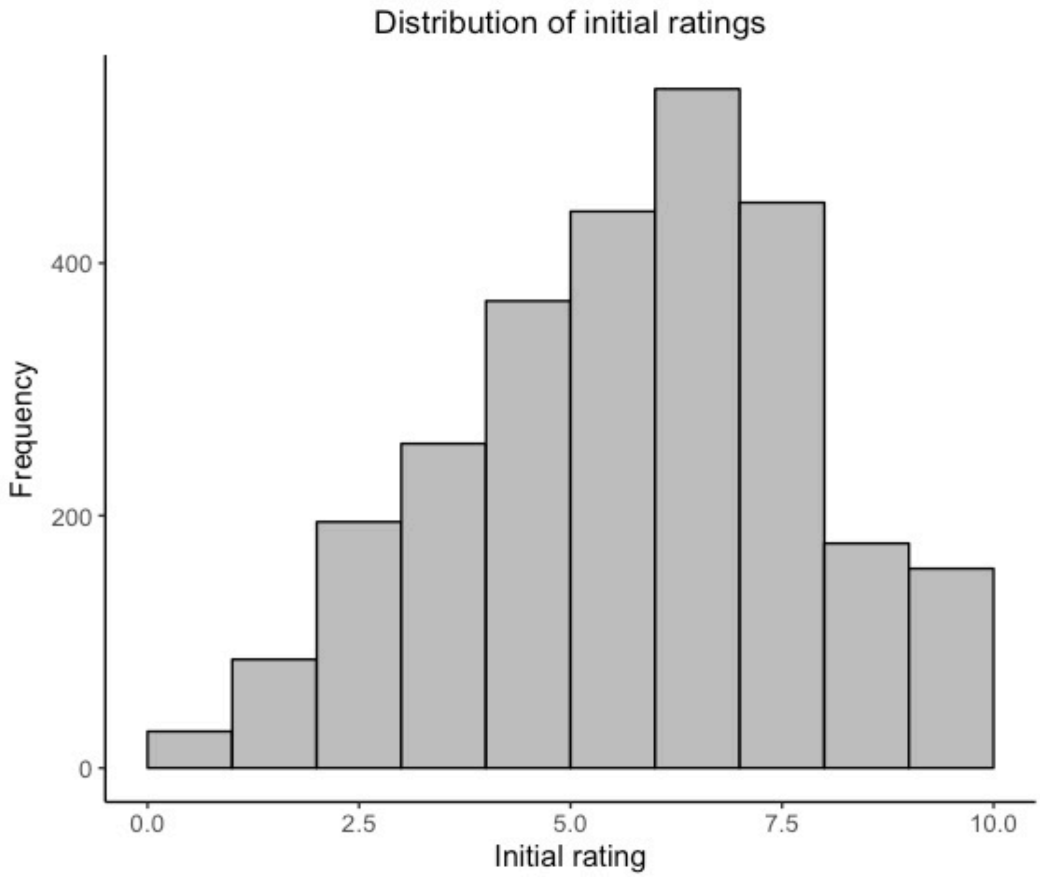

Fig. S2. Histogram showing the distribution of initial ratings across all trials.

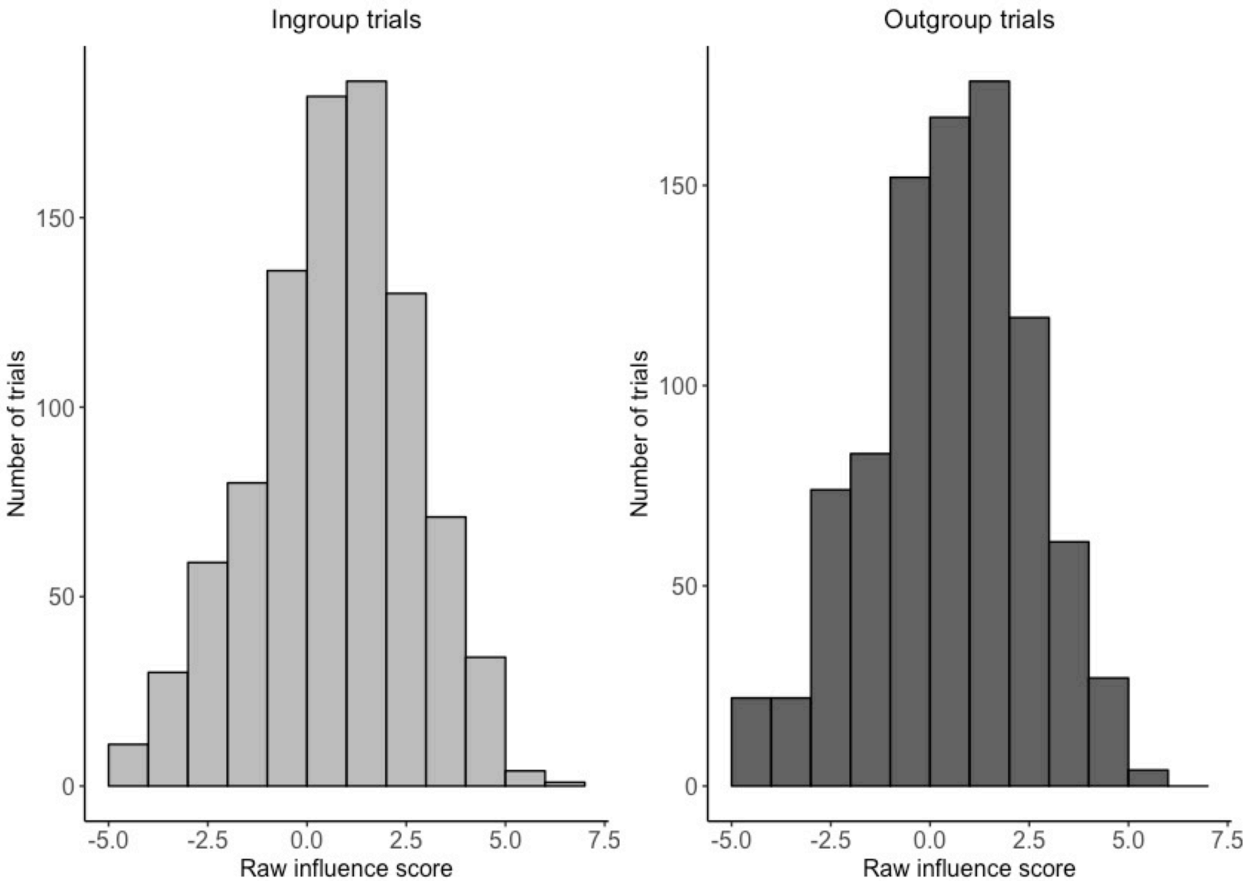

Fig. S3. Histogram showing the distribution of raw influence scores for ingroup and outgroup feedback across all (moderate) trials and across all participants. Raw influence score is defined as the difference between a participant's final and initial score for a given trial taking into account the direction of the movement (positive if they moved towards the influence and negative if they moved away from the influence).

Table S1. Brain regions that showed increased tracking of social influence from ingroup than outgroup members

Anatomical Region	x	y	z	*t*	*k*
Left vlPFC	-34	20	-16	5.39	3323[a]
Left amygdala	-20	2	-20	5.00	[a]
Left insula	-28	20	-20	3.91	[a]
Left caudate (VS)	-8	10	-6	3.50	[a]
Left temporal pole	-54	2	-24	3.46	[a]
Right vlPFC	50	42	-6	4.89	1996[b]
Right middle frontal gyrus	48	42	26	3.28	[b]
Right insula	28	20	-18	4.16	[b]
vmPFC	-4	60	-18	4.54	2109[c]
Left superior medial gyrus (dmPFC)	-2	60	32	3.73	[c]
mPFC	6	54	0	3.29	[c]
Left superior medial gyrus	-10	48	12	3.62	[c]
Thalamus	6	-30	6	4.15	607[d]
Right middle temporal gyrus	66	-28	-8	4.02	386[e]
Right pSTS	64	-32	-10	3.99	[e]
Right cerebellum	12	-44	-44	3.47	538[f]
Brainstem	-6	-38	-54	3.63	[f]

Note. x, y, and z refer to MNI coordinates; *t* refers to the t-score at those coordinates (local maxima); *k* refers to the number of voxels in each significant cluster. vlPFC = ventrolateral prefrontal cortex. VS = ventral striatum. vmPFC = ventromedial prefrontal cortex. dmPFC = dorsomedial prefrontal cortex. mPFC = medial prefrontal cortex. pSTS = posterior superior temporal sulcus. Regions with the same superscript indicate they belong to the same cluster of activation.

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