Supporting Information

Schmälzle et al. 10.1073/pnas.1616130114

SI Materials and Methods

Definition of Regions. To define the nodes for our analysis, we used Neurosynth (36) to perform two automated meta-analyses of the functional neuroimaging literature on mentalizing and social pain, respectively. In particular, for mentalizing, we queried the Neurosynth database (as of January, 2016) for published studies on the topic of "mentali*" (threshold = 0.001). This query resulted in a set of 112 studies with associated MNI coordinates, which we then submitted to a Neurosynth meta-analysis and saved the FDR 0.01-corrected reverse inference (RI) map. We proceeded analogously for studies of social pain (search term "social* & pain*"; 39 studies). Finally, we extracted result clusters from the mentalizing and social pain RI maps using BSPMview. In addition, we consulted two separate researcher-curated meta-analyses of mentalizing (61) and social pain (4), respectively. Overall, there was good agreement between the coordinates obtained via automated meta-analysis, with minor differences for the "social & pain" Neurosynth analysis, which returned additional coordinates not found in researcher-curated analyses. Closer inspection revealed that these likely stem from leakage of studies on physical pain, and thus they were excluded. To select network coordinates, we discarded regions with cluster sizes below 140 mm^3 and symmetrized the coordinates of bilateral nodes. For instance, the center coordinates for the insula were 40, 6, −4 and −36, 8, −4, and these were symmetrized to 38, 7, −4, i.e., the midpoint. This procedure provided the following coordinates for the mentalizing network (Fig. S2): DMPFC, (0, 53, 30); vmPFC, (0, 48, −18); precuneus, (0, −54, 44); rTPJ, (48, −56, 23); lTPJ, (−48, −56, 23); rMTG, (53, −12, −16); and lMTG, (−53, −12, −16) and the following coordinates for the social pain network: dACC, (0, 16, 32); r-aINS, (38, 7, −4); and l-aINS, (−38, 7, −4). Results reported are substantively similar with or without inclusion of these nodes: cerebellum, (−24, −50, −45); brainstem1, (−3, −25, −23); brainstem2, (−5, −22, −42); brainstem3, (5, −22, −42); somatosensory1, (62, 28, 42); and somatosensory2, (−60, −22, 34); furthermore, substantively similar results are also obtained with asymmetric node-coordinates.

Stronger Connectivity in the Mentalizing Network During Social Exclusion: Edge-Level Results. The results reported in the main paper are based on the connectivity within and between the social pain and mentalizing networks, respectively. To assess results at a finer spatial resolution, we focused on individual edges and asked whether edge strength differed significantly between social exclusion and inclusion. The results of this analysis, shown in Fig. S2, revealed that the edges that exhibited changes in connectivity between exclusion and inclusion mainly connected regions from the mentalizing network but not from the social pain network (see Fig. S1, thresholded at $P < 0.05$, uncorrected, for exploratory purposes).

Assessing the Robustness of Effects Within the Mentalizing Network. The robustness of the dynamic fluctuations within the mentalizing network was investigated in a control analysis that compared time courses from the first and second half of each block, confirming our main findings that showed increased within-network connectivity was sustained throughout the first and second halves of each block [first half: $t_{Mentalizing\ first\ half:\ exclusion\ vs.\ inclusion}(79) = 2.23$; $P = 0.029$, and second half: $t_{Mentalizing\ second\ half:\ exclusion\ vs.\ inclusion}(79) = 2.57$, $P = 0.012$], and that connectivity did not differ between the first and second halves [$t_{Mentalizing,\ exclusion,\ first\ vs.\ second}(79) = 0.24$, $P = 0.812$; $t_{Mentalizing,\ inclusion,\ first\ vs.\ second}(79) = 0.94$, $P = 0.348$] (Fig. S3). This analysis suggests not that participants were increasingly mind-wandering or otherwise engaging in default mode activity over time but rather that our analysis likely tracks social cognitive processes relevant to the task.

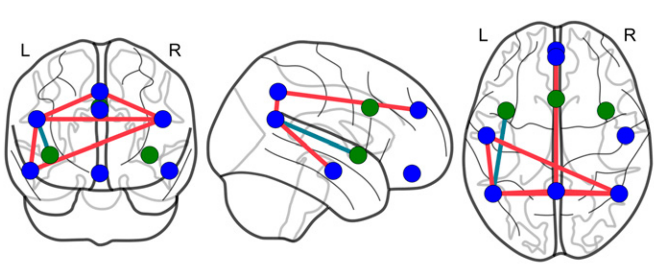

Fig. S1. Social exclusion is associated with increased connectivity in the mentalizing network. Node colors indicate the network/community membership of each node (blue = mentalizing/default mode network, green = social pain/saliency network); edge colors indicate the direction of the difference in connectivity between social exclusion vs. inclusion (i.e., red edges = increased connectivity during exclusion; blue edges = decreased connectivity; these results are thresholded at $P < 0.05$, uncorrected, for exploratory purposes). The following edges are significant: dmPFC–precuneus: $t(79) = 3.042$, $P = 0.003$; precuneus–rTPJ: $t(79) = 2.569$; $P = 0.012$; precuneus–lTPJ: $t(79) = 2.487$; $P = 0.015$; rTPJ-lMTG: $t(79) = 2.277$, $P = 0.025$; lTPJ-rTPJ: $t(79) = 2.323$, $P = 0.023$; lTPJ-lMTG: $t(79) = 2.764$. $P = 0.007$; laINS-lTPJ: $t(79) = −2.304$, $P = 0.024$.

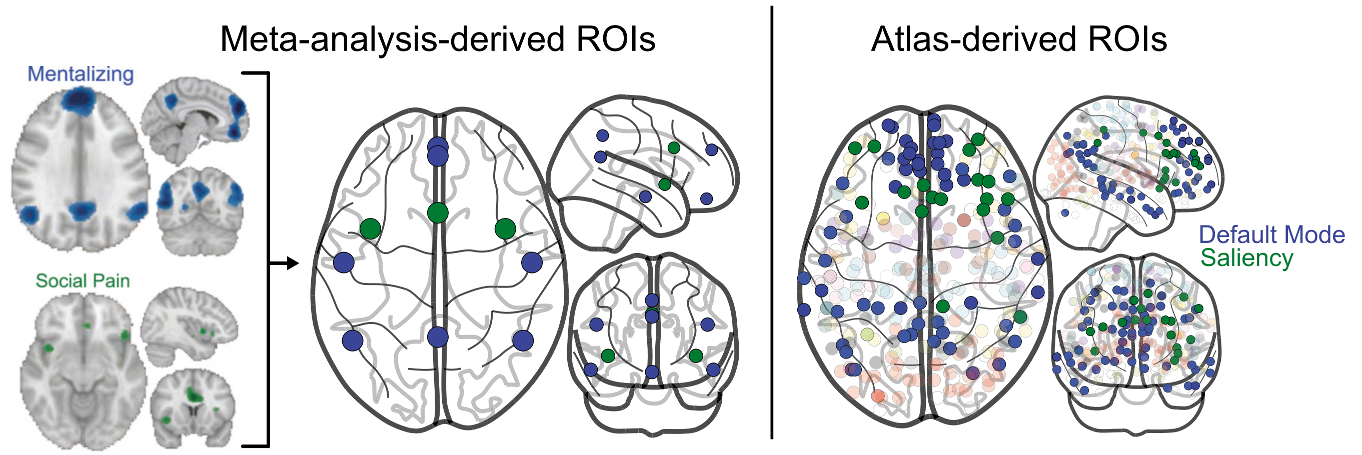

Fig. S2. The nodes for social pain and mentalizing networks as derived by synthesizing automated and researcher-curated meta-analyses on mentalizing (58) and social pain (11), respectively. The brain images (*Left*) show the meta-analytic contrast of the RI maps (pFgA; FDR, q = 0.01; smoothed 8 mm FWHM), which are combined to yield the parcellation shown in the schematic brain figure (*Center*). The *Right* pictures the regions used in the whole-brain analysis, with the default mode network colored in blue to reflect its overlap with the mentalizing network and the saliency network colored green to capture its overlap with the social pain network.

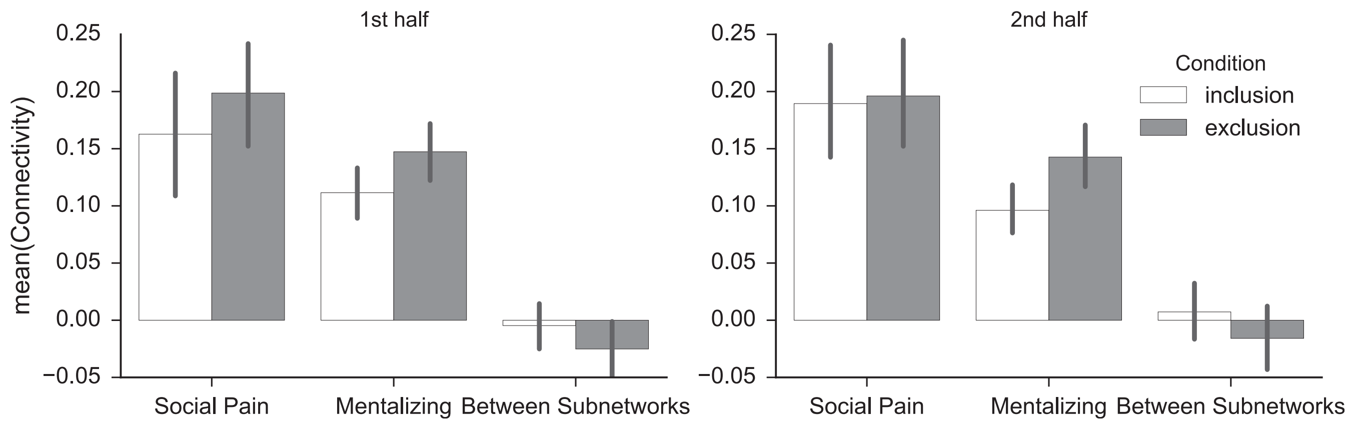

Fig. S3. Social exclusion was associated with increased connectivity within the mentalizing network. This figure is based on the analyses illustrated in Fig. 3 in the main text but was computed using data from only the first or second half of each block, respectively.