**Supplementary Note**

**Behavioral Results.** Because our task involved simple manual responses to the onset of a high-contrast, centrally presented, and expected target, reaction times were very fast in both experiments. In E1, mean response time was 290ms, and subjects were significantly faster (paired \( t(26) = 4.0; p < 0.001 \)) on subject-receiving trials (mean = 264ms) than on charity-receiving trials (mean = 316ms). Comparison of low- and high-altruism subjects, as determined by median split, revealed no significant differences in reaction time between the groups (high-altruism = 270 ms; low-altruism = 300 ms; \( t(26) = 1.6; p > 0.1 \)), nor was the difference between response times on subject-receiving and charity-receiving trials significant (high-altruism = 40 ms; low-altruism = 57 ms; \( t(26) = 0.7; p > 0.1 \)). In E2, reaction times were again very fast (mean = 225ms). There was not a significant difference in response times for subject-receiving trials (mean = 220ms) and charity-receiving trials (mean = 230ms), nor were reaction times significantly correlated with any of our psychometric measures (all \( p \)s > 0.10).

**Psychometric Measures.** In Experiment 1, subjects completed the Self-Report Altruism Scale (SRAS) after completion of the fMRI scanning session. This instrument contains 20 questions asking how often the subject engages in a range of altruistic behaviors (e.g., giving directions to a stranger; donating to charity). Subjects were not informed beforehand that they would be completing this questionnaire. Because some of the questions on the standard SRAS are not applicable to the population of young adults from which our sample is drawn (e.g., pushing a stranger’s car out of the snow), we subjected the full SRAS scale to a cluster analysis to identify which questions maximally differentiated between our subjects. We found that a cluster of 10 questions accounted for most of the variance in scores between our subjects. We derived an altruism score from subjects’ answers to these ten items; while possible scores ranged from 0-40, scores of subjects in our sample ranged from 13-35 (mean = 24.8; s.d. = 4.8).

Note that we established the derived altruism measure before (and independently of) the analysis of the fMRI data. All figures and tables in this manuscript use the derived altruism score, not the full SRAS. However, we also note that the original and derived altruism scores were highly correlated (\( r = 0.88 \)) within our sample. We therefore repeated all analyses using the full SRAS score. This includes revised versions of all analyses shown in Supplementary Fig. 1. In nearly all cases, the correlations between altruism and activation (in pSTC and elsewhere) were actually greater when using the full SRAS (see Supplementary Table 1), reflecting that the
eliminated 10 questions added some, albeit small, predictive power. However, because we made an a priori decision to use the derived scale – which does carry the advantage of having fewer questions – we only report that data in this manuscript. All correlations use two-tailed tests, for conservatism.

We recognized while conducting E1 that the use of the SRAS was not ideal for our subject population. Therefore, we designed for E2 a new altruism scale that contains questions appropriate for individuals drawn from our typical fMRI subject population: young adults who are students or employees in a university community. This scale, the Personal Altruism Level (PAL), is provided in Supplementary Data.

In addition to the subset of 10 SRAS questions and the PAL, subjects completed three other psychometric surveys. The Barrett Impulsivity Scale² (BIS) measures impulsivity in cognitive, motor, and planning dimensions. The Interpersonal Reactivity Index³ (IRI) provides measures of four components of empathy: empathic concern, fantasy, personal distress, and perspective taking. The NEO-FFI⁴ is a basic personality test assessing agreeableness, conscientiousness, extraversion, openness, and neuroticism. Subjects also completed a modified version of the Allocation Task⁵, which provides a measure of individual preferences for fairness.

The PAL scores were highly correlated with SRAS scores ($r = 0.77$, $p = 0.0001$), and showed trends toward positive correlations with psychometric measures that involved perception of the actions and beliefs of others (IRI empathic concern: $r = 0.44$, $p = 0.07$; IRI perspective taking: $r = 0.45$, $p = 0.07$). We thus focus our analyses on the full-scale PAL throughout the discussions of E2.

**Relations between fMRI Data and Psychometric Variables**

**Experiment 1.** Our primary interest was the Watching > Playing contrast. We used three methods to control for the problem of multiple comparisons, which is endemic to imaging data. First, in both experiments, we used initial voxelwise fMRI analyses only to identify active regions. The resulting small set of regions was then subjected to a second test that examined the correlations with an independent behavioral measure (SRAS score). This greatly reduces the number of independent comparisons, from many thousands of voxels to a handful of regions of interest (ROIs). Second, we conducted identical analyses on two independent portions of our data, subject-receiving and charity-receiving trials. Although we report (Supplementary Table 3) any region that exhibited a significant effect on any test at the $p < 0.05$ level, we restricted our discussion to those regions that exhibited a significant effect in both trial types. Finally, we used both forward and backward stepwise regression analyses (Statistica, StatSoft, inc.; all analysis
parameters kept at defaults) to verify whether addition of regions improved the predictions of altruism scores. The former begins with no variables and iteratively evaluates whether addition of a given variable to the model improves the fit significantly, while the latter begins with all variables and evaluates whether a given variable can be removed without reducing the quality of the model fit.

There were consistent relations between self-reported altruism and [Watching > Playing] activation of the right pSTC (Figs. 2a,b), for both subject-receiving trials ($r = 0.45; p = 0.02$) and charity-receiving trials ($r = 0.56; p = 0.002$; Supplementary Table 3). The left pSTC showed a significant correlation on subject-receiving trials ($p = 0.02$), but only a trend toward significance on charity-receiving trials ($p = 0.09$); a similar pattern was found for the left temporal pole ($p = 0.03, 0.09$). Within these regions, altruism was associated with increased activity on watching trials and decreased activity on playing trials.

We also conducted a targeted analysis on right pSTC by median-splitting our subjects into low-altruism and high-altruism groups. Four subjects shared the median altruism score. This resulted in $n=15$ within the low-altruism group and $n=12$ within the high-altruism group. To verify that this uneven split did not influence the results, we conducted resampling analyses that split those four subjects between the low- and high-altruism groups in all possible combinations. The results were similar across all combinations: there was never a significant result at $p < 0.2$ in the low-altruism condition, and always a significant result at $p < 0.002$ in the high-altruism condition. Thus, we report data from the above splitting of our subjects in all subsequent analyses and in Fig. 2a.

**Experiment 2.** We identified brain regions whose activation was significantly greater during Watching blocks than Playing blocks using a mixed-effects, voxelwise analysis (see Supplementary Methods). Only two regions exhibited significant activation differences: right pSTC (Fig. 1) and bilateral orbitofrontal cortex (see Supplementary Table 2). To evaluate whether activation in these regions predicted altruism or other psychometric measures, we then added each measure as a regressor and repeated the fMRI analysis. The right pSTC activation was correlated with the PAL measure of altruism as well as two measures of prosocial behavior, the IRI-Empathic-Concern and the NEO-Openness ($all ps < 0.05$). The OFC activation was correlated with several measures, including IRI-fantasy, IRI-empathic concern; NEO-agreeableness, NEO-conscientiousness, NEO-extraversion and NEO-openness; the friend subscale of the PAL; and the SRAS ($all ps < 0.05$). None of these OFC correlations survived the removal of individual outlier subjects.
To gain converging evidence for the specificity of the brain-altruism relations, we next performed region of interest (ROI) analyses targeted at the two identified regions. We defined 27-voxel ROIs surrounding the center-of-gravity coordinates of the regions identified in the voxel-wise analyses. We then examined correlations across subjects between the parameter estimates for the [Watching > Playing] contrast and each of our psychometric measures (see Supporting Table 4). There was a significant correlation between PAL scores and right pSTC activation ($r = 0.57, p < 0.01$; see Fig. 2c,d). Post-hoc analyses indicated that this correlation was completely driven by the charity-receiving trials; that is, altruism correlated with right pSTC activation when money was to be earned for the charity ($r = 0.55, p = 0.02$), but not when money was to be earned for the subject ($r = 0.04$). No correlation between right pSTC activation and any other psychometric measure reached significance at the $p < 0.05$ level, even uncorrected for multiple comparisons, nor did any psychometric measure significantly correlate with activation of OFC.

Like in E1, we conducted forward and backward stepwise regression analyses to examine the specificity of these results to altruism. As predictors in the model, we included scores on the Allocation and SRAS scales, as well as each of the individual subscales of the BIS, IRI, NEO, and the PAL. The dependent measure was the difference in parameter estimates between Watching and Playing in right pSTC. Both forward and backward regressions converged to the same solution, with only two factors making significant contributions to right pSTC activation: PAL scores (positively; $F = 10.2, p = 0.006$) and the Fantasy component of the IRI (negatively; $F = 4.7, p = 0.05$). Based on the consistency of these results, we conclude that activation of the right pSTC predicts self-reported altruism.

Finally, we evaluated simple correlations between activation and altruism scores across our subjects. We present right pSTC correlations graphically in Fig. 2b,d and all correlation values are provided in Supporting Tables 2 and 4.

Conclusions. Each of our two experiments provided independent evidence for the differential activation of the right pSTC when watching a computer perform a task and playing the task. Furthermore, both studies indicated that self-reported altruism predicts activity in this region. Notably, the pSTC activation in high altruism subjects for E2 was completely driven by charity-receiving trials; in E1 there were significant effects for both charity-receiving trials than subject-receiving trials, with a higher correlation observed in the former.

Only a small set of regions showed activation in the [Watching > Playing] contrast, and of these regions only the pSTC showed significant and independent correlations with our altruism...
measures. The pSTC has been implicated in a diversity of tasks from target detection to empathic responding, which may reflect both functional and spatial heterogeneity. Both analyses of the entire activated pSTC and analyses of a ROI defined by the pSTC centroid revealed significant brain-altruism correlations. However, in E2 we also conducted exploratory analyses in subsections of the pSTC, and there were suggestions that the amplitude of the [Watching > Playing] contrast was not predicted by altruism measures in the most superior part of the activated region. This is consistent with a parsing of pSTC function such that more caudal-superior aspects support low-level perceptual processing of actions, and more rostral-inferior aspects support complex analysis of social and biological components of stimuli. For example, Perrett et al. hypothesize that the STC in macaques plays an important role in recognizing food exploitation by conspecifics. The functional distribution of centroids for tasks involving theory of mind, oddball, and target detection processes (cf. Supplementary Fig. 2) provide initial, albeit very cursory, support for this functional topography within pSTC.

There is mounting evidence that the pSTC is involved in various types of empathic perception, including emotional empathy as well as the perception of other's goal-directed behavior. Many of the studies evoking pSTC activity have used complex biological or social stimuli, typically with human actors. Our study demonstrates that this region is activated by simple, non-biological stimuli, as well. In our task, subjects viewed a very impoverished stimulus on Watching trials (i.e., a single target that appears and disappears). The flash of this target serves as a signal to the subject that the computer has responded for that trial. Our interpretation of this result is that subjects are perceiving this stimulus as an intentional or agent-produced action, and that this attribution of agency drives the pSTC response. Furthermore, the finding that low-altruism subjects did not show increases in pSTC for Watching trials suggests that there are individual differences in predispositions to interpret observed events as intentional acts of an agent. Consistent with this framework, pSTC activation has been observed when subjects play economic games both with a computer and with a human, but with greater amplitude when the opponent is human.
References

2. Barratt, E. S. Psychol Rep 16, 547-54 (1965).