1. SUPPLEMENTAL METHODS

1.1 Participant Information

1.1.1 Patient Sample

Individuals were recruited from outpatient clinics, drop-in centers, and using community advertisements. Schizophrenia/schizoaffective diagnosis was confirmed using the Structured Clinical Interview for DSM-IV-TR Axis I Disorders – Patient Edition (First, Spitzer, Miriam, & Williams, 1995). Patients were required to not meet criteria for substance and/or alcohol abuse or dependence within the past 6 months (assessed using modules from the Mini-International Neuropsychiatric Interview (Sheehan et al., 1998)), and were required to have premorbid intelligence of at least 75 estimated using the Wechsler Test of Adult Reading (WTAR). Lastly, participants were required to have no significant medical illness, no magnetic resonance imaging contraindications, and no history of head injury or prolonged unconsciousness.

Of the 30 patients retained for analyses, the following describes their antipsychotic (AP) medication use; medication information was only available for 29 patients. Two patients were taking one typical AP. One patient was taking one typical AP and one atypical AP. Fourteen patients were taking one atypical AP. Five patients were taking two or more atypical APs. Seven patients were not taking any APs.

1.1.2 Twin Sample

Participants recruited for the original Minnesota Twin Study included twins born in Minnesota between 1971 and 1985, identified through birth records provided by the Minnesota State Health Department. See Kramer et al. (Kramer, Patrick, Krueger, & Gasperi, 2012) for initial eligibility criteria, which exclude for mental or physical handicaps preventing study
completion. Otherwise, as an epidemiological study, the Minnesota Twin Study did not have specific diagnostic or mental health criteria. Participants were mailed a packet of questionnaires, including the brief version of the Multidimensional Personality Questionnaire (MPQ) (Patrick, Curtin, & Tellegen, 2002), which contained the Alienation scale used in the current study. The Alienation scale measures persecutory ideations dimensionally, with item content assessing themes such as “sees self as a target of false rumors”, “feels betrayed or deceived” and, “believes other wish him/her to fail” (12 items total, Cronbach’s alpha=0.82) (Patrick et al., 2002).

Participants were 18-33 years of age at the time of the original mailing as part of the Minnesota Twin Study. In the current study, twin participants were re-contacted based on initial MPQ Alienation scores. Twin participants were required to have no significant medical illness, no magnetic resonance imaging contraindications, and no history of head injury or prolonged unconsciousness at point of reassessment for the current study. During the current study community twin participants were assessed with the SCID for DSM-IV-TR Axis I Disorders – Non-Patient Edition (First, et. al., 2002) during participation in the current study. These assessments showed 11% of twin subjects had a current Axis I diagnosis, which consisted only of anxiety disorders (1 subject) and depressive disorders (3 subjects). An additional 29% of twin subjects had a past Axis I diagnosis but no current diagnosis; these past diagnoses included mood disorders (5 subjects) and substance use disorders (6 subjects). Such proportions are on par with national estimates in the US (Kessler & Wang, 2008) suggesting this sample functioned as intended as a community sample for the present analysis. In accord with this level of psychopathology, the twin sample provided reasonable distribution on the measure of interest, the Alienation Scale from the Multidimensional Personality Questionnaire, which served here as a subclinical measure of persecutory ideation. Importantly, none of the twin participants were
diagnoses with schizophrenia or schizoaffective disorder.

1.2 MTG task details

1.2.1 Additional Task Details

Further illustration of Minnesota Trust Game (MTG) task stimuli is shown in Figure S1a and S1b. All information about the decision-agent, temptation, and adverse payoff remain on the screen during the entire choice phase. The choice phase ends once the participant selects a card (top or bottom card in v.4.0), or after six seconds. After selecting a card (or time expires), the participant sees a confirmation of their action in gray, followed by a fixation screen that precedes the next trial. Choosing the top card indicates the participant will not trust the decision-agent and results in assured outcomes of $10 for participant and the other player. Choosing the bottom card indicates the participant will trust the decision-agent to determine outcomes, with the possible payoffs to the participant and to the other player displayed on this card. No feedback is provided regarding the decision-agent’s selected outcomes once they are trusted. The participant is told that for each trial they are paired with an anonymous other player, but no information about the other player is provided. For both samples, the only difference between the other player and coin flip trials is the text prompt in the middle indicating which of these types the current trial is. The intertrial interval, defined by the time between the onset of one trial and the onset of the next trial, was 16 seconds as shown in Figure S1a, for both MTG v.3.0 and v. 4.0. Eprime software (Psychology Software Tools) was used for task programming and presentation.

1.2.2 Task Presentation Differences

The two samples in the current study completed slightly different versions of the MTG
The twin sample completed MTG v.3.0, which required memorizing color codes and locations to understand the presented values and decision options. In MTG v3.0, left and right button presses (controlled by separate hands) on a 4-button response box were used to make trust versus no-trust choices. In a small patient sample task comprehension was poor with v.3.0. Therefore, the task was modified for patient data collection to reduce potential confusion and cognitive load. In MTG v.4.0, which the current patient sample completed, distinct physical representations of choices were used to reduce cognitive load, and the term “partner” was changed to “other player” to reduce perception of partnership or team that could influence strategy. In MTG v.4.0, top and bottom button presses (controlled by separate hands) on a 4-button response box were used to make trust versus no-trust choices.

1.2.3 Other Task Differences

Across v.3.0 and v.4.0 all parameters were the same except for adverse payoff, which was extended in the patient sample to provide greater range to ensure comprehension and collection of validity trials. However, trial sequencing differed also across the v.3.0 and v.4.0, again to reduce cognitive confounds in the patient sample.

In v.3.0, completed by the twin sample, each scan included 28 trials that equally sampled across levels of decision agent (DA; Other Player or Coin), temptation (T; $15 or $25), and adverse payoff (AD: ranged from $15 to $-5). Specifically, for other player game and coin game each, 4-10 trials presented the condition where \( t=\$15 \) and the remainder the condition where \( t=\$25 \); in version 3.0 game types (coin and other player) were interleaved in their presentation. The level of AD was sampled to create a spread of risk that was equally distributed across conditions and game types per scan. While the proportion of specific conditions/parameters...
varied across the three scans in v3.0, when considering the three scan blocks, there was an equal number of trials for each of the conditions (DAxT), and an equal number of trials for each AD level (continuous integer of risk, e.g., -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15) that were evenly spread across the conditions.

In v.4.0 completed by the patient sample, other player and coin trials were segregated to separate scans to reduce cognitive confounds; each scan included 18 trials that equally sampled across levels of temptation (T; $15 or $25) and adverse payoff (AD: ranged from $20 to $-10). Specifically, the proportion of trials was standardized within the scans, such that 9 trials presented the condition where t=$15 and 9 trials presented the condition where t=$25. The level of AD was sampled to create a spread of risk equally distributed across conditions and game types. When considering the three scan blocks per game type (other player and coin separately for a total of 6 scans), there was equal number of trials for each AD level (nearly continuous integer of risk, e.g., -10, -8, -6, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 20) that were evenly spread across the conditions. Finally, in the patient sample, 60 seconds of rest were collected at the end of each scan.

1.2.4 Training and Compensation

All participants received thorough instruction about the MTG and practiced the task prior to scanning to ensure they understand the consequences of their decisions. To facilitate and ensure comprehension in the patient sample, computer practice followed interactive training with flash cards during which participants demonstrated understanding of consequences associated with different choices. Instruction emphasized there was no right or wrong answer, but that their choices could influence their final payment and that of an anonymous player. Following standard
behavioral economic practice there was no deception, and participants were aware of all conditional elements at the time of the decision. Final payments were based on randomly selected decisions using previous participant responses for the other player’s choice as necessary. It was explained to participants that they would receive addition payment beyond basic study participation depending on their choices during the MTG. In the twin sample participants received an addition $5-$40. In the patient sample participants received an additional $10-$45.

1.3 Trust Score Calculation

Trust scores were calculated as follows. For each trial, the difference between the guaranteed payoff of $10 and the adverse payoff (AD) value was calculated, and then multiplied by 1 if the participant trusted the decision-agent, or 0 if they did not, for that trial. Resulting values were summed across trials then divided by the number of scans completed. This score was calculated across all trials, as well as for each condition of the MTG, such as across suspiciousness condition trials, or rational mistrust condition trials, to examine specificity. Robust regression was employed for individual differences analyses using this variable to down-weight outliers.

1.4 Neuroimaging Acquisition

1.4.1 Patient Sample

Task scans used an event-related design, lasted for 5.87 minutes, and were acquired in a Siemens Trio 3T scanner (Erlangen, Germany) with a 12-channel head-coil. Sequence parameters included: gradient-echo echo-planar imaging of 176 volumes, repetition time = 2 s; echo time = 28 ms; flip angle = 90°, 35 contiguous oblique angle axial slices (from the inferior
edge of the cerebellum to the inferior edge of orbital frontal cortex to reduce sinus related signal drop-out), voxel size = 3.5 × 3.5 × 3.5 mm, matrix = 64 × 64 × 35. A high-resolution T1-weighted anatomical image was acquired using a magnetization prepared rapid gradient-echo sequence (MPRAGE), repetition time = 2530 ms, echo time = 3.65 ms, flip angle = 7°, 224 coronal slices, voxel size = 1 x 1 x 1 mm, matrix = 176 x 256 x 224. Each subject completed six task scans during the session: three scans of other player game trials, three scans of coin game trials. To reduce possible confusion presentation did not alternate between game types. Presentation order was counterbalanced across participants. Participants with at least two scans of each game type were included in the analysis.

1.4.2 Twin Sample

Task scans used an event-related design, lasted for 7.73 minutes, and were acquired in a Siemens Trio 3T scanner (Erlangen, Germany) with a 12-channel head-coil. Sequence parameters included: gradient-echo echo-planar imaging of 232 volumes, repetition time = 2 s; echo time = 28 ms; flip angle = 90°, 35 contiguous oblique angle axial slices (from the inferior edge of the cerebellum to the inferior edge of orbital frontal cortex to reduce sinus related signal drop-out), voxel size = 3.5 × 3.5 × 3.5 mm, matrix = 64 × 64 × 35. A high-resolution T1-weighted anatomical image was acquired using a magnetization prepared rapid gradient-echo sequence (MPRAGE), repetition time = 2530 ms, echo time = 3.65 ms, flip angle = 7°, 160 coronal slices, voxel size = 1 x 1 x 1 mm, matrix = 256 x 256 x 160. Notably, while data collection for each sample was conducted in two independent studies, acquisition parameters were very similar across the samples. Each subject completed three task scans during the session; each scan alternated between sets of other player game trials and coin game trials. Participants
with at least two scans were included in the analysis.

1.5 Neuroimaging Processing

The same preprocessing was applied to the functional magnetic resonance imaging (fMRI) scans collected from both samples. Standard fMRI preprocessing within FSL (version 4.1.9; www.fmrib.ox.ac.uk/fsl) included slice-timing correction, motion correction (Jenkinson, Bannister, Brady, & Smith, 2002), brain extraction (Smith, 2002), grand-mean intensity normalization of the 4D data set (all volumes) by the same multiplicative factor, high-pass temporal filtering set at 100 s, 6-mm FWHM smoothing, spatial normalization and linear registration of the functional images to high-resolution structural images (Jenkinson et al., 2002), and nonlinear registration to MNI152 space (Andersson, Smith, & Jenkinson, 2008).

Participants with poor quality neuroimaging data or excessive movement (mean absolute displacement > 1.5mm or any movement > 3.0 mm/degrees) were excluded as stated in the main text. Additional processing steps to further reduce the influence of motion included the following. For activation analyses, the six motion parameters were added as covariates in the general linear model. For connectivity analyses, a six-parameter motion regression was employed on preprocessed and registered data to reduce residual influence of movement. Scrubbing or censoring of the data, a method mainly recommended for resting-state fMRI that discards volumes with excessive movement (Power, Schlaggar, & Petersen, 2015; Siegel et al., 2014), was not further applied to our task fMRI data for connectivity analyses. This was because motion correction, motion regression, ICA, and dual regression using all derived components were applied to reduce motion influence on subsequent metrics in our connectivity pipeline. Previous work suggests that scrubbing does not substantially change results when ICA and dual
regression have been applied in addition to conventional methods to address motion (Starck et al., 2013), as was conducted here. Moreover, we did not employ scrubbing because it alters the temporal structure of the data precluding some analyses (Yan et al., 2013), and scrubbing can produce widely varying scan lengths (and thus, degrees of freedom) across individuals for which concerns have been noted (Power et al., 2015; Yan et al., 2013). Finally, if movement were a factor increasing proximal correlations and decreasing distal correlations between voxels as has been observed for resting-state connectivity (Power et al., 2015), this would detract from our observed task-related correlations, increasing the risk of type II errors more than the risk of type I errors. Nonetheless, to further rule out the presence of motion confounds we tested relationships between quantified movement (mean absolute displacement) and network connectivity metrics across subjects during post-hoc specificity analyses.

2. SUPPLEMENTAL RESULTS

2.1 Supplemental and Exploratory Activation Results

Supplemental analyses using general linear models (GLM) further compared the overall task-relatedness across the two game types as part of the initial validation of brain activation during the MTG in patients with schizophrenia. As stated in the main text, whole-brain analyses showed high degree of overlap among Other Player Game and Coin Game activations (see Figure S2). The statistical comparison showed only an occipital pole cluster (max peak at x=20 y=-98 z=18) had a significant difference in activation (z>3.09). An exploratory test for a relationship with persecutory ideation showed no association with this cluster (β= 0.04, t(28)= 0.21, p=0.835).
Exploratory whole brain analyses of the specific task-relatedness contrasts using GLMs further identified significant (z>3.09) left sensorimotor activations were associated with the suspiciousness contrast (NTr SUS15 – Tr SUS15) and the rational mistrust contrast (NTr RMT25 – Tr RMT25), as described in the main text. Exploratory tests for relationships with individual differences in persecutory ideation showed no association for the suspiciousness contrast left sensorimotor activation (β= 0.06, t(23)= 0.29, p=0.776) and no association for the rational mistrust contrast left sensorimotor activation (β= -0.04, t(27)= -0.21, p=0.833).

### 2.2 Supplemental and Exploratory Connectivity Results

Supplemental analyses further compared the overall task-relatedness metrics across the two game types as part of the initial validation of brain connectivity during the MTG. Here Fisher Z-tests, examining the difference between the overall task-relatedness correlations for the two game types using the R package “cocor”, were employed since raw correlations across the two scan types were compared instead of contrast metrics resulting from within-scan subtractions. Results showed none of the ten *a priori* networks, nor any of the remaining 14 networks, showed significantly different overall task-relatedness across the two game types (all ps > 0.8).

The connectivity methods described in the main text for examining *a priori* contrasts of specific task-relatedness were additionally completed for the remaining 14 non *a priori* networks in exploratory analyses. As shown in the bottom portion of Table S3c, only the suspiciousness contrast metrics comparing no trust versus trust decisions within that condition (NTr SUS15 – Tr SUS15) showed significant one-sample tests that identified changes in non *a priori* networks. Among the four identified networks here, one was limited to the occipital pole (IC 3), two
included both superior parietal and primary sensory regions (IC 11 and 27), and one network was limited to the cerebellum (IC 9). However, most of these networks would not survive the appropriate multiple comparison correction and exploratory tests for relationships between their suspiciousness contrast metrics and individual differences persecutory ideation showed no associations (all ps > 0.1). Similarly, the interconnectivity during the other player game between these four non a priori networks, as well as between these four networks and the three a priori networks highlighted by the main analyses (IC 12, 14, 24), showed no associations with individual differences in persecutory ideation (all ps > 0.1). One exception is the interconnectivity between the non a priori IC3 and IC11 where there was a negative relationship with persecutory ideation ($\beta = -0.38$, $t(28) = -2.12$, $p=0.043$). However, this relationship would not survive the appropriate correction for multiple comparisons and was confounded by an association with movement (absolute movement in the scanner and this interconnectivity were negatively associated, $\beta = -0.41$, $t(28) = -2.63$, $p=0.013$), neither of which were the case for the key interconnectivity finding in the main analyses. Thus, these limited exploratory findings do not provide compelling evidence to suggest a substantive role of these non a priori networks in persecutory ideation. Finally, there were no significant findings among non a priori networks for the rational mistrust contrast metrics comparing no trust versus trust decisions within that condition (NTr RMT25 – Tr RMT25) or the critical no trust contrast metrics comparing no trust decision in the suspiciousness condition versus no trust decisions in rational mistrust condition (NTr SUS15 – NTr RMT25). Taken together, the supplemental and exploratory analyses do not add to the key findings in the main text, except to reinforce the specificity of the main analyses, particularly the relationship between persecutory ideation and the vmPFC/OFC – IFP interconnectivity during the Other Player Game.
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## SUPPLEMENTAL TABLES

### Table S1. Hierarchical regression models predicting MTG decisions in schizophrenia

| Variable or Interaction | Coefficient (β) | Z-Value | P-Value  |
|-------------------------|-----------------|---------|----------|
| (Intercept)             | -0.33           | -1.03   | 0.302    |
| Decision Agent (DA)     | 1.07            | 9.29    | < 0.001  ** |
| Temptation Payoff (T)   | -1.32           | -11.37  | < 0.001  ** |
| Adverse Payoff (AD)     | 2.85            | 9.24    | < 0.001  ** |
| Persecutory Ideation    | -0.24           | -1.15   | 0.249    |
| DA x Persecutory Ideation | -0.49     | -3.15   | 0.002  ** |
| DA x T x Persecutory Ideation | 0.78     | 4.44    | < 0.001  ** |
| DA x AD x Persecutory Ideation | 0.70 | 3.56    | < 0.001  ** |
| DA x T x AD x Persecutory Ideation | -0.37  | -1.65   | 0.099    |

### a. All Trials

| Variable or Interaction | Coefficient (β) | Z-Value | P-Value  |
|-------------------------|-----------------|---------|----------|
| (Intercept)             | 1.38            | 3.85    | < 0.001  ** |
| Temptation Payoff (T)   | -2.48           | -13.39  | < 0.001  ** |
| Adverse Payoff (AD)     | 2.31            | 7.84    | < 0.001  ** |
| Persecutory Ideation    | -0.85           | -2.36   | 0.019    * |
| T x Persecutory Ideation| 0.68            | 3.62    | < 0.001  ** |
| AD x Persecutory Ideation | 0.63     | 1.96    | 0.050    * |
| T x AD x Persecutory Ideation | -0.23  | -1.08   | 0.280    |

### b. Other Player Trials

| Variable or Interaction | Coefficient (β) | Z-Value | P-Value  |
|-------------------------|-----------------|---------|----------|
| (Intercept)             | -2.39           | -3.47   | < 0.001  ** |
| Temptation Payoff (T)   | -0.29           | -1.39   | 0.164    |
| Adverse Payoff (AD)     | 6.55            | 6.39    | < 0.001  ** |
| Persecutory Ideation    | -0.50           | -0.81   | 0.418    |
| T x Persecutory Ideation| 0.41            | 1.92    | 0.055    |
| AD x Persecutory Ideation | -0.29   | -0.35   | 0.730    |
| T x AD x Persecutory Ideation | 0.01  | 0.03    | 0.978    |

### c. Coin Trials

| Variable or Interaction | Coefficient (β) | Z-Value | P-Value  |
|-------------------------|-----------------|---------|----------|
| (Intercept)             | 1.37            | 3.03    | 0.003    ** |
| Adverse Payoff (AD)     | 1.38            | 4.63    | < 0.001  ** |
| Persecutory Ideation    | -0.84           | -1.88   | 0.060    |
| AD x Persecutory Ideation | 0.60     | 2.06    | 0.039    * |

### d. SUS15 (Other Player) Trials

| Variable or Interaction | Coefficient (β) | Z-Value | P-Value  |
|-------------------------|-----------------|---------|----------|
| (Intercept)             | -2.13           | -3.82   | < 0.001  ** |
| Adverse Payoff (AD)     | 4.92            | 6.46    | < 0.001  ** |
| Persecutory Ideation    | -0.02           | -0.04   | 0.968    |
| AD x Persecutory Ideation | 0.44     | 0.68    | 0.494    |

### e. RMT25 (Other Player) Trials

Mixed effects logistic regression models predicting trust vs. no trust decisions in each sample. SUS15, suspiciousness condition. RMT25, rational mistrust condition. * significant using p < .05, ** significant using p < .005
### Table S2. Post-hoc tests of overall task-relatedness of coherence for each network during each game type in schizophrenia

| Description of network                                      | Other Player |       |       | Coin |       |       |
|-------------------------------------------------------------|--------------|-------|-------|------|-------|-------|
| **A priori networks for main hypothesis testing**           | mean (fz)    | P-value | mean (fz) | P-value |       |       |
| IC 10: Doral medial prefrontal                              | -0.08        | < 0.001 ** | -0.09 | < 0.001 ** |       |       |
| IC 12: Dorsal cingulate & anterior insula                    | 0.36         | < 0.001 ** | 0.30  | < 0.001 ** |       |       |
| IC 14: Ventral medial/orbital prefrontal                     | -0.17        | < 0.001 ** | -0.13 | < 0.001 ** |       |       |
| IC 34: Striatal & thalamic                                  | 0.12         | < 0.001 ** | 0.11  | < 0.001 ** |       |       |
| IC 5: Lateral temporal                                      | -0.03        | 0.157   | -0.05 | 0.006 |       |       |
| IC 7: Inferior parietal                                     | 0.04         | 0.094   | 0.03  | 0.191 |       |       |
| IC 18: Insular & superior temporal                          | 0.01         | 0.376   | 0.02  | 0.166 |       |       |
| IC 44: Medial temporal & temporal pole                       | -0.11        | < 0.001 ** | -0.07 | < 0.001 ** |       |       |
| IC 2: Right frontal-parietal                                | 0.15         | < 0.001 ** | 0.13  | < 0.001 ** |       |       |
| IC 24: Left frontal-parietal                                | -0.04        | 0.149   | -0.08 | < 0.001 ** |       |       |
| **Remaining networks for exploratory analyses**             |              |       |       |      |       |       |
| IC 1: Medial occipital                                      | 0.23         | < 0.001 ** | 0.21  | < 0.001 ** |       |       |
| IC 3: Occipital pole                                       | 0.37         | < 0.001 ** | 0.35  | < 0.001 ** |       |       |
| IC 4: Lateral pre-post central                              | -0.03        | 0.098   | -0.03 | 0.209 |       |       |
| IC 8: Precuneus & posterior cingulate                       | -0.08        | < 0.005 ** | -0.11 | < 0.001 ** |       |       |
| IC 9: Cerebellum                                            | 0.15         | < 0.001 ** | 0.12  | < 0.001 ** |       |       |
| IC 11: Lateral occipital & superior parietal                | 0.38         | < 0.001 ** | 0.31  | < 0.001 ** |       |       |
| IC 13: Superior medial pre-post central                     | -0.04        | 0.114   | -0.04 | 0.065 |       |       |
| IC 15: Supplemental motor                                   | 0.15         | < 0.001 ** | 0.11  | < 0.001 ** |       |       |
| IC 22: Lateral prefrontal                                   | 0.19         | < 0.001 ** | 0.15  | < 0.001 ** |       |       |
| IC 25: Superior prefrontal                                  | 0.01         | 0.657   | -0.02 | 0.075 |       |       |
| IC 27: Right superior parietal & pre-post central           | 0.27         | < 0.001 ** | 0.26  | < 0.001 ** |       |       |
| IC 33: Right frontal-temporal                               | 0.11         | < 0.001 ** | 0.10  | < 0.001 ** |       |       |
| IC 35: Left superior parietal & pre-post central            | 0.26         | < 0.001 ** | 0.27  | < 0.001 ** |       |       |
| IC 51: Dorsal striatal & thalamic                           | 0.10         | < 0.001 ** | 0.08  | < 0.001 ** |       |       |

For each game separately the tests of overall task-relatedness were inclusive of all trials regardless of response or condition to examine overall network engagement during the task. Mean task-relatedness values reported using Fisher’s z’ (fz). T-stats with associated p-values derived from one-sample t-tests across participants (all 2-tailed); degrees of freedom (df) = 29. Note, networks were bilateral unless otherwise specified. IC, independent component. ** significant after correction for 10 a priori networks (p< .005).
### Table S3. Post-hoc tests of *a priori* contrasts of specific task-relatedness of coherence during Other Player Game in schizophrenia

| Description of network | a. Suspiciousness Contrast NTr SUS15 - Tr SUS15 | b. Rational Mistrust Contrast NTr RMT25 - Tr RMT25 | c. No Trust Contrast NTr SUS15 - NTr RMT25 |
|------------------------|-------------------------------------------------|-------------------------------------------------|------------------------------------------|
|                        | mean (fz) | P-value | mean (fz) | P-value | mean (fz) | P-value |
| **A priori networks for main hypothesis testing** | | | | | | |
| IC 10: Doral medial prefrontal | 0.03 | 0.314 | 0.00 | 0.824 | 0.05 | 0.065 |
| IC 12: Dorsal cingulate & anterior insula | -0.06 | < 0.005 ** | 0.04 | 0.062 | -0.03 | 0.314 |
| IC 14: Ventral medial/orbital prefrontal | 0.02 | 0.308 | -0.04 | 0.043 | 0.06 | < 0.005 ** |
| IC 34: Striatal & thalamic | -0.05 | 0.808 | -0.02 | 0.372 | -0.03 | 0.273 |
| IC 5: Lateral temporal | -0.03 | 0.120 | 0.01 | 0.498 | 0.00 | 0.932 |
| IC 7: Inferior parietal | 0.00 | 0.986 | 0.02 | 0.449 | 0.02 | 0.294 |
| IC 18: Insular & superior temporal | 0.00 | 0.852 | 0.03 | 0.020 | 0.01 | 0.644 |
| IC 44: Medial temporal & temporal pole | -0.01 | 0.801 | -0.01 | 0.600 | -0.02 | 0.353 |
| IC 2: Right frontal-parietal | -0.04 | 0.037 | -0.01 | 0.750 | -0.01 | 0.599 |
| IC 24: Left frontal-parietal | 0.00 | 0.977 | -0.05 | < 0.005 ** | 0.03 | 0.183 |
| **Remaining networks for exploratory analyses** | | | | | | |
| IC 1: Medial occipital | -0.04 | 0.404 | 0.04 | 0.087 | -0.01 | 0.753 |
| IC 3: Occipital pole | -0.08 | < 0.005 ** | -0.03 | 0.226 | -0.03 | 0.229 |
| IC 4: Lateral pre-post central | 0.01 | 0.733 | 0.03 | 0.089 | 0.03 | 0.150 |
| IC 8: Precuneus & posterior cingulate | -0.04 | 0.079 | -0.04 | 0.100 | 0.02 | 0.388 |
| IC 9: Cerebellum | -0.06 | < 0.005 ** | 0.00 | 0.843 | -0.04 | 0.059 |
| IC 11: Lateral occipital & superior parietal | -0.07 | < 0.005 ** | 0.03 | 0.246 | -0.06 | 0.013 |
| IC 13: Superior medial pre-post central | 0.02 | 0.344 | 0.05 | 0.007 | 0.01 | 0.371 |
| IC 15: Supplmental motor | -0.02 | 0.385 | 0.02 | 0.370 | -0.01 | 0.805 |
| IC 22: Lateral prefrontal | -0.01 | 0.415 | 0.00 | 0.885 | 0.02 | 0.442 |
| IC 25: Superior prefrontal | -0.03 | 0.190 | 0.00 | 0.981 | 0.01 | 0.696 |
| IC 27: Right superior parietal & pre-post central | -0.12 | < 0.001 ** | -0.05 | 0.044 | -0.01 | 0.713 |
| IC 33: Right frontal-temporal | 0.02 | 0.416 | -0.01 | 0.545 | 0.01 | 0.634 |
| IC 35: Left superior parietal & pre-post central | 0.01 | 0.632 | 0.08 | 0.006 | -0.04 | 0.043 |
| IC 51: Dorsal striatal & thalamic | -0.02 | 0.399 | 0.01 | 0.444 | -0.02 | 0.196 |

The three contrasts represent different experimental questions. Contrasts identified changes in networks’ task-relatedness of coherence across specific pairs of events. Mean contrast values reported using Fisher’s $z$’ (fz). T-stats with associated p-values derived from one-sample t-tests across participants (all 2-tailed). Degrees of freedom (df) differed based on response frequencies of subjects in each condition: A) df=24, B) df=28, C) df=24. Note, networks were bilateral unless otherwise specified. IC, independent component. Tr, Trust; NTr, No Trust; SUS15, suspiciousness condition; RMT25, rational mistrust condition. ** significant after correction for 10 *a priori* networks (p< .005).
Table S4. Hierarchical regression models predicting MTG decisions in community twins

| Variable or Interaction | a. All Trials | b. Other Player Trials | c. Coin Trials | d. SUS15 (Other Player) Trials | e. RMT25 (Other Player) Trials |
|-------------------------|---------------|------------------------|----------------|--------------------------------|-------------------------------|
|                         | Coefficient (β) | Z-Value | P-Value | Coefficient (β) | Z-Value | P-Value | Coefficient (β) | Z-Value | P-Value | Coefficient (β) | Z-Value | P-Value |
| (Intercept)             | -0.35         | -1.21     | 0.226  | 1.86             | 4.95    | <0.001  | -1.65           | -3.39    | <0.001  | 1.75             | 5.09     | <0.001  |
| Decision Agent (DA)     | 1.77          | 14.99    | <0.001 | **               | -1.74   | -9.68   | <0.001 | **               | 1.74     | -9.68   | <0.001   | **               |
| Temptation Payoff (T)   | -0.86         | -7.87    | <0.001 | **               | 1.34    | 7.39    | <0.001 | **               | 4.02     | 7.76    | <0.001   | **               |
| Adverse Payoff (AD)     | 1.90          | 10.80    | <0.001 | **               | 0.05    | -0.27   | 0.786  |                 | -0.05   | -0.27   | 0.786    |                 |
| Persecutory Ideation    | 0.27          | 2.36     | 0.018  |                 | 0.58    | 2.31    | 0.021  | *               | 0.58     | 2.31    | 0.021    | *               |
| DA x Persecutory Ideation | -1.43     | -9.00    | <0.001 | **               | -0.03   | -0.16   | 0.871  |                   | -0.03   | -0.16   | 0.871    |                   |
| DA x T x Persecutory Ideation | 1.27     | 7.34    | <0.001 | **               | -0.63   | -1.80   | 0.072  |                  | -0.63   | -1.80   | 0.072    |                  |
| DA x AD x Persecutory Ideation | 0.35     | 2.27    | 0.023  | *               | -0.14   | -0.76   | 0.448  |                   | -0.14   | -0.76   | 0.448    |                   |
| DA x T x AD x Persecutory Ideation | -0.14 | -0.76 | 0.448 |                   |         |         |        |                  |         |         |        |
| DA x T x AD x T x Persecutory Ideation | -0.14 | -0.76 | 0.448 |                   |         |         |        |                  |         |         |        |

Mixed effects logistic regression models predicting trust vs. no trust decisions in each sample. Twin models were corrected for non-independence of observations. SUS15, suspiciousness condition. RMT25, rational mistrust condition. * significant using p < .05, ** significant using p < .005.
Table S5. Tests of overall task-relatedness of coherence for each network during each game type in community twins

| Description of a priori networks | Other Player | Coin |
|---------------------------------|-------------|-----|
| **A priori networks for main hypothesis testing** | mean (fz) P-value | mean (fz) P-value |
| IC 10: Dorsal medial prefrontal | -0.07 < 0.001 ** | -0.11 < 0.001 ** |
| IC 12: Dorsal cingulate & anterior insula | 0.27 < 0.001 ** | 0.27 < 0.001 ** |
| IC 14: Ventral medial/orbital prefrontal | -0.15 < 0.001 ** | -0.17 < 0.001 ** |
| IC 34: Striatal & thalamic | 0.10 < 0.001 ** | 0.11 < 0.001 ** |
| IC 5: Lateral temporal | 0.01 0.678 | -0.05 0.005 ** |
| IC 7: Inferior parietal | -0.01 0.537 | 0.01 0.258 |
| IC 18: Insular & superior temporal | -0.03 0.002 ** | -0.01 0.248 |
| IC 44: Medial temporal & temporal pole | -0.11 < 0.001 ** | -0.10 < 0.001 ** |
| IC 2: Right frontal-parietal | 0.15 < 0.001 ** | 0.13 < 0.001 ** |
| IC 24: Left frontal-parietal | 0.02 0.177 | 0.00 0.762 |

For each game separately the tests of overall task-relatedness were inclusive of all trials regardless of response or condition to examine overall network engagement during the task. Mean task-relatedness values reported using Fisher’s z’ (fz). T-stats and p-values derived from one-sample t-tests across participants (all 2-tailed); degrees of freedom (df) = 18 to correct for non-independence of observations. Note, networks were bilateral unless otherwise specified. IC, independent component. ** significant after correction for 10 a priori networks (p < .005).
**Table S6.** Post-hoc tests of specificity for specific task-relatedness contrast findings in schizophrenia

| Network          | Higher-Level Contrast Within Other Player Game                        | mean (fz) | P-value |
|------------------|-----------------------------------------------------------------------|-----------|---------|
| dACC-AI          | (NTr SUS15 - Tr SUS15) † - (NTr RMT25 - Tr RMT25)                     | -0.10     | < 0.001 * |
| IF-P             | (NTr SUS15 - Tr SUS15) - (NTr RMT25 - Tr RMT25) †                   | 0.05      | 0.110   |
| vmPFC/OFC        | (NTr SUS15 - NTr RMT25) † - (Tr SUS15 - Tr RMT25)                    | 0.08      | 0.007 * |

| Network          | Higher-Level Contrast Across Games                                    | mean (fz) | P-value |
|------------------|-----------------------------------------------------------------------|-----------|---------|
| dACC-AI          | (NTr SUS15 - Tr SUS15) † - (NTr RA15 - Tr RA15)                       | -0.07     | 0.025 * |
| IF-P             | (NTr RMT25 - Tr RMT25) † - (NTr RA25 - Tr RA25)                       | -0.03     | 0.082   |
| vmPFC/OFC        | (NTr SUS15 - NTr RMT25) † - (NTr RA15 - NTr RA25)                     | 0.08      | 0.013 * |

Only networks with significant contrasts of specific task-relatedness metrics were included in higher-level contrasts, which examined how the original contrasts differed from parallel contrasts within Other Player Game, and across games. Original contrasts found to be significant for each network indicated by italics and †. Mean higher-level contrast values reported using Fisher’s z’ (fz). T-stats and associated p-values derived from one-sample t-tests across participants (all 2-tailed). dACC-AI, dorsal cingulate and anterior insula network; IF-P, left frontal-parietal; vmPFC/OFC, ventral medial/orbital prefrontal cortex network; Tr, Trust; NTr, No Trust; SUS15, suspiciousness condition; RMT25, rational mistrust condition; RA15, risk aversion 15 condition; RA25, risk aversion 25 condition. * significant using p < .05
Table S7. Post-hoc tests of specificity for key individual differences findings in schizophrenia and community twins

| Relationship | Patients (N=30) | Twins (N=38) |...
|-------------|----------------|--------------|
| Coefficient (β) | T-stat | P-value | Coefficient (β) | T-stat | P-value |
| Rational Mistrust Condition Trust Scores: Persecutory Ideation | 0.08 | 0.41 | 0.688 |
| Coin Game Trust Scores: Persecutory Ideation | 0.04 | 0.21 | 0.838 |
| Suspiciousness Condition Trust Scores: Other Positive Symptoms | -0.24 | -1.08 | 0.288 |
| Suspiciousness Condition Trust Scores: Negative Symptoms | 0.18 | 1.17 | 0.254 |
| Suspiciousness Condition Trust Scores: Anxiety/Depression Symptoms | 0.26 | 1.29 | 0.207 |
| Suspiciousness Condition Trust Scores: Manic/Disorganization Symptoms | -0.11 | -0.62 | 0.540 |
| Suspiciousness Condition Trust Scores: Overall Severity of Symptoms | -0.04 | -0.21 | 0.832 |
| Suspiciousness Condition Trust Scores: Premorbid Intelligence | 0.16 | 0.87 | 0.394 |
| Rational Mistrust Condition Trust Scores: Persecutory Ideation | -0.14 | -0.72 | 0.483 |
| Coin Game Trust Scores: Persecutory Ideation | 0.06 | 0.28 | 0.786 |

To test specificity, main associations findings were examined for other task conditions or other symptoms or premorbid intelligence (WTAR), and neuroimaging findings were tested for confounds of movement. Positive, negative, anxiety/depression, and manic/disorganization symptom factors from the BPRS were calculated based on Ruggeri et al. 2005; to represent "other" positive symptoms the score was calculated without the suspiciousness rating (since used as the measure of persecutory ideation in the present study). Overall symptom severity was calculated as the average of all 24 BPRS ratings. Tests in the twin sample employed all 38 subjects and corrected for non-independence of observations. All tests used robust regression and were 2-tailed. vmPFC/OFC, ventral medial/orbital prefrontal network; IF-P, left frontal-parietal network; dACC-AI, dorsal cingulate and anterior insula network; OTP, other player game.
SUPPLEMENTAL FIGURE LEGENDS

**Figure S1.** (a) Flow-diagram for each trial of the Minnesota Trust Game (MTG), which illustrates that confirmation of participant’s choice is provided, but no feedback about the decision-agent’s choice is provided. Possible payoffs for participant shown in yellow and for the other player in blue. AD, adverse payoff. T, temptation. (b) Comparison of MTG stimuli used in each sample for the same trial. Version 4.0 was used in the patient sample and designed to minimize confusion and cognitive load, as compared to version 3.0 that was used in the community twin sample and required greater memorization for the meaning of colors and locations to make an informed decision.

**Figure S2.** Whole-brain comparison of Other Player Game and Coin Game overall task-relatedness activation findings (z>3.09) in schizophrenia. Overall task-relatedness activations during the two game types were highly similar. Overlap of activations in purple; non-overlapping Other Player Game activations in red and non-overlapping Coin Game activations in blue. Supplemental statistical comparison of Coin > Other revealed a single significant cluster (z>3.09) in occipital cortex (shown in green and encircled in yellow); the Other > Coin test showed no significant clusters. Other regions of non-overlap did not significantly differ. Z under each brain above refers to slice location along the superior-inferior axis.

**Figure S3.** Replication of overall effects of task on behavior and brain networks in community twins. (a) Behavioral findings illustrating that only decisions during the suspiciousness condition, which measures spite sensitivity, were related to individual differences in persecutory ideation using the MPQ alienation scale (LO = T-score ≤ 60, HI = T-score > 60) in the twins. (b)
Visualization of overall task-relatedness results for each *a priori* network during each game type separately in twins. Each bar indicates the degree to which fluctuations in the network’s coherence were associated with task events, plotted as mean task-relatedness using Fisher’s $z$’; error bars represent SEM. IC, independent component; OTP, Other Player Game; COIN, Coin Game. For comparison to pattern of findings in schizophrenia, see Figure 1d and Figure 3 bottom, respectively.

**Figure S4.** Post-hoc specificity tests for specific task-relatedness contrast findings in schizophrenia. Parallel contrasts were examined, and higher-level contrasts tested, to clarify the specificity of the original *a priori* contrasts illustrated in Figure 4. Statistics for the higher-level contrasts reported in Table S6. (a) Finding for Suspiciousness Contrast, defined as NTr SUS15 – Tr SUS15. (b) Finding for Rational Mistrust Contrast, defined as NTr RMT25 – Tr RMT25. (c) Finding for No Trust Contrast, defined as NTr SUS15 – NTr RMT25. Left column shows networks with significant findings for each of the original contrasts. Right column summarizes specific task-relatedness metrics for the different events for each network, with colored bars representing the means using Fisher’s $z$’ and error bars representing SEM; note, additional bars added due to specificity testing compared to original Figure 4. The three original *a priori* contrasts of specific task-relatedness that were found to be significant are indicated by bold black lines (same as in Figure 4). Here, parallel contrasts (which are themselves non-significant) are indicated by dashed gray lines. The higher-level contrasts between the original contrasts and respective parallel contrasts are indicated by thin black lines. IC, independent component; Tr, Trust; NTr, Not Trust; SUS15, suspiciousness condition; RMT25 rational mistrust condition; RA15, risk aversion 15; RA25, risk aversion 25. **, $p<0.005$; *, $p<0.05$, ns, non-significant.
SUPPLEMENTAL FIGURES

Figure S1.

a. Choice (M=2 s, SD=0.5)  Confirmation (2 s)  Fixation (M=12 s, SD=0.3)

You take 10  You take 10  You take 10

0  20  0  20  ?  20

Other Player Decides Other Player Decides +

15  20  15  20  ?  20

Time (1 trial)

b. Version 4.0  Version 3.0

You take 10  10  0  20

0  20  Partner

Other Player Decides 10  15  20

15  20
Figure S2.
Figure S3.

**a. Trusting in Community Twins Split by Alienation Severity (HI vs. LO) Across Conditions**

**b. Networks in Community Twins**

- **IC 10**
- **IC 12**
- **IC 14**
- **IC 34**
- **IC 05**
- **IC 07**
- **IC 18**
- **IC 44**
- **IC 02**
- **IC 24**
Figure S4.

a. IC 12: Dorsal cingulate & anterior insular (dACC-AI)

b. IC 24: Left frontal-parietal (IF-P)

c. IC 14: Ventral medial/orbital prefrontal (vmPFC/OFC)