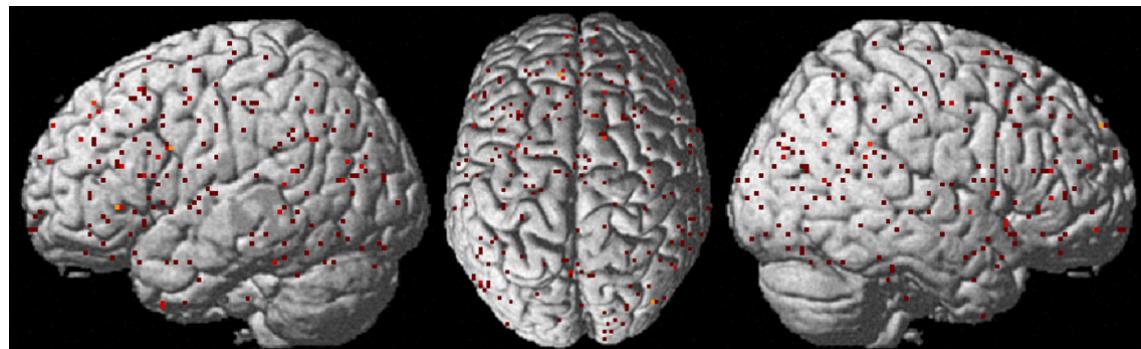


Supplementary Material

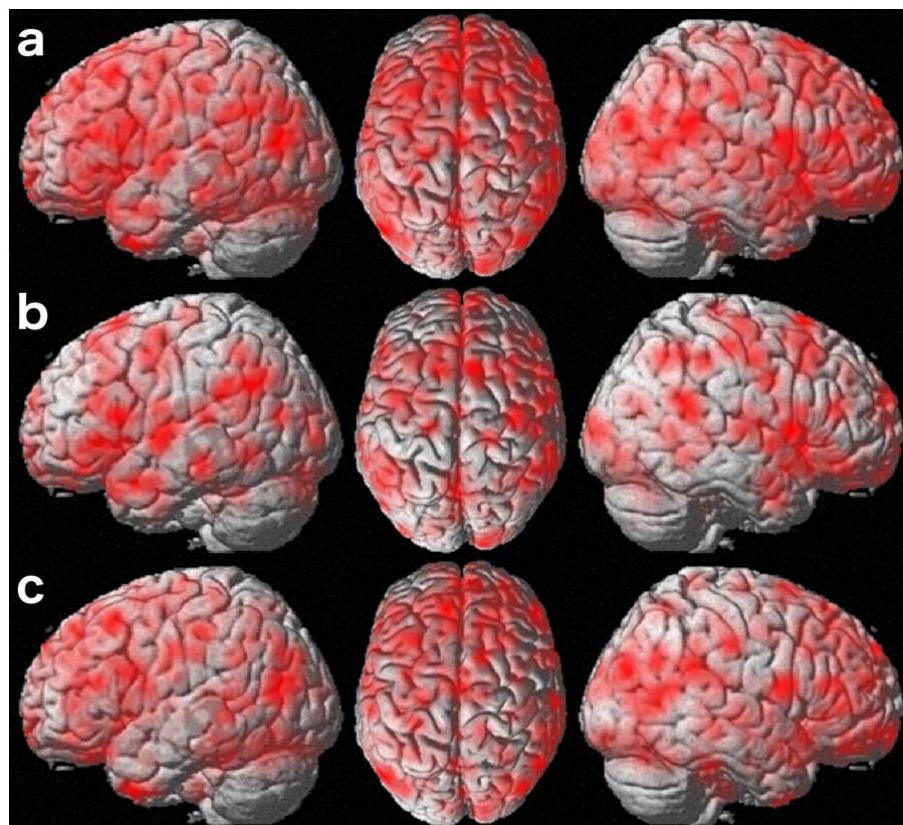
Supplementary Figure 1

Summary of the 753 activation foci reported in all 155 experiments included in the meta-analyses.



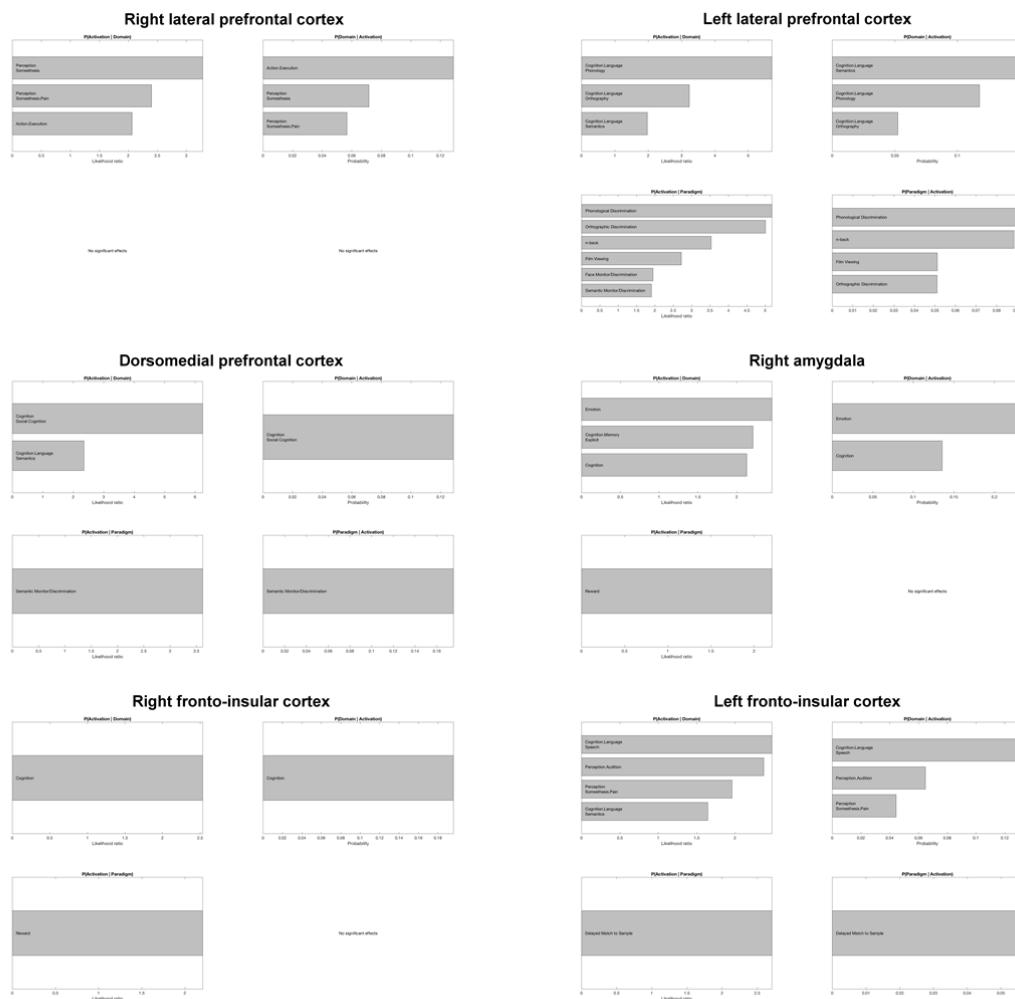
Supplementary Figure 2

Activation likelihood estimates (ALE), reflecting, for each voxel, the union of the modeled activation (MA) maps across (a) all experiments reporting aberrant brain activity associated with psychopathy, (b) experiments reporting increased brain activity associated with psychopathy, and (c) experiments reporting decreased brain activity associated with psychopathy.



Supplementary Figure 3

Functional characterization of brain regions featuring aberrant activity associated with psychopathy.



Significant associations with psychological terms (behavioral domains and paradigm classes) from BrainMap metadata. In the forward inference approach ($P(\text{Activation} \mid \text{Domain/Paradigm})$), a cluster's functional profile was determined by identifying taxonomic labels for which the probability of finding activation in the respective cluster was significantly higher than the overall chance (across the entire database) of finding activation in that particular cluster. Reverse inference ($P(\text{Domain/Paradigm} \mid \text{Activation})$) determined the above-chance probability of association with a behavioral function given observed brain activity in the respective region ($p < 0.05$, uncorrected). The base rate denotes the general probability of finding BrainMap activation in the region. The x-axis indicates relative probability values.

Supplementary Table

Studies reporting neuroimaging experiments alterations in brain activity associated with psychopathy

First author	Year	Subjects			Scale	Imaging	Task	Subject-Level Analysis	Group-Level Analysis	Foci	Direction
		Psychopaths	Controls	Others							
Caldwell	2015	-	-	87	PCL-R	fMRI	Moral processing	Moral > Non-Moral	Correlation w/ PCL-R Factor 1	0	+
		-	-	87	PCL-R	fMRI	Moral processing	Moral > Non-Moral	Correlation w/ PCL-R Factor 1	2	-
		-	-	87	PCL-R	fMRI	Moral processing	Moral > Non-Moral	Correlation w/ PCL-R Factor 2	0	+
		-	-	87	PCL-R	fMRI	Moral processing	Moral > Non-Moral	Correlation w/ PCL-R Factor 2	0	-
Contreras-R.	2014	22	22	-	PCL-R	fMRI	Emotional processing	Happy+Fearful > Shapes	Psychopaths > Controls	5	+
		22	22	-	PCL-R	fMRI	Emotional processing	Fearful > Shapes	Psychopaths > Controls	2	+
		22	22	-	PCL-R	fMRI	Emotional processing	Happy > Shapes	Psychopaths > Controls	2	+
		22	-	-	PCL-R	fMRI	Emotional processing	Happy+Fearful > Shapes	Correlation w/ PCL-R Factor 1	3	+
		22	-	-	PCL-R	fMRI	Emotional processing	Happy+Fearful > Shapes	Correlation w/ PCL-R Factor 2	5	-
		-	-	137	PCL-R	fMRI	Cue-induced drug craving	Drug-related > Neutral	Correlation w/ PCL-R	10	-
Cope	2014	-	-	137	PCL-R	fMRI	Cue-induced drug craving	Drug-related > Neutral	Correlation w/ PCL-R	1	+
		-	-	137	PCL-R	fMRI	Cue-induced drug craving	Drug-related > Neutral	Correlation w/ PCL-R Factor 1	6	+
		-	-	137	PCL-R	fMRI	Cue-induced drug craving	Drug-related > Neutral	Correlation w/ PCL-R Factor 2	46	-
		-	-	137	PCL-R	fMRI	Cue-induced drug craving	Drug-related > Neutral	Correlation w/ PCL-R Facet 1	13	+
		-	-	137	PCL-R	fMRI	Cue-induced drug craving	Drug-related > Neutral	Correlation w/ PCL-R Facet 2	2	+
		-	-	137	PCL-R	fMRI	Cue-induced drug craving	Drug-related > Neutral	Correlation w/ PCL-R Facet 2	9	-
		-	-	137	PCL-R	fMRI	Cue-induced drug craving	Drug-related > Neutral	Correlation w/ PCL-R Facet 3	5	+
		-	-	137	PCL-R	fMRI	Cue-induced drug craving	Drug-related > Neutral	Correlation w/ PCL-R Facet 3	25	-
		-	-	137	PCL-R	fMRI	Cue-induced drug craving	Drug-related > Neutral	Correlation w/ PCL-R Facet 4	1	+
		-	-	137	PCL-R	fMRI	Cue-induced drug craving	Drug-related > Neutral	Correlation w/ PCL-R Facet 4	35	-
Decety	2013	24	22	-	PCL-R	fMRI	Empathy processing	Pain Interaction	Controls > Psychopaths	3	-
		24	22	-	PCL-R	fMRI	Empathy processing	Pain Interaction	Psychopaths > Controls	13	+
		24	22	-	PCL-R	fMRI	Empathy processing	Pain Expression	Controls > Psychopaths	15	-
		24	22	-	PCL-R	fMRI	Empathy processing	Pain Expression	Psychopaths > Controls	2	+
		24	46	-	PCL-R	fMRI	Empathy processing	Pain Interaction	Correlation w/ PCL-R Factor 1	11	+
		24	46	-	PCL-R	fMRI	Empathy processing	Pain Interaction	Correlation w/ PCL-R Factor 2	4	+
		24	46	-	PCL-R	fMRI	Empathy processing	Pain Interaction	Correlation w/ PCL-R Factor 1	2	-

		24	46	-	PCL-R	fMRI	Empathy processing	Pain Interaction	Correlation w/ PCL-R Factor 2	2	-
		24	46	-	PCL-R	fMRI	Empathy processing	Pain Expression	Correlation w/ PCL-R Factor 1	2	+
		24	46	-	PCL-R	fMRI	Empathy processing	Pain Expression	Correlation w/ PCL-R Factor 2	1	+
		24	46	-	PCL-R	fMRI	Empathy processing	Pain Expression	Correlation w/ PCL-R Factor 1	8	-
		24	46	-	PCL-R	fMRI	Empathy processing	Pain Expression	Correlation w/ PCL-R Factor 2	10	-
Decety 2014		24	22	-	PCL-R	fMRI	Emotion processing	Happiness > Baseline	Controls > Psychopaths	17	-
		24	22	-	PCL-R	fMRI	Emotion processing	Happiness > Baseline	Psychopaths > Controls	3	+
		24	46	-	PCL-R	fMRI	Emotion processing	Happiness > Baseline	Correlation w/ PCL-R Factor 1	14	-
		24	46	-	PCL-R	fMRI	Emotion processing	Happiness > Baseline	Correlation w/ PCL-R Factor 2	9	-
		24	46	-	PCL-R	fMRI	Emotion processing	Happiness > Baseline	Correlation w/ PCL-R Factor 1	0	+
		24	46	-	PCL-R	fMRI	Emotion processing	Happiness > Baseline	Correlation w/ PCL-R Factor 2	0	+
		24	22	-	PCL-R	fMRI	Emotion processing	Fear > Baseline	Controls > Psychopaths	17	-
		24	22	-	PCL-R	fMRI	Emotion processing	Fear > Baseline	Psychopaths > Controls	3	+
		24	46	-	PCL-R	fMRI	Emotion processing	Fear > Baseline	Correlation w/ PCL-R Factor 1	8	-
		24	46	-	PCL-R	fMRI	Emotion processing	Fear > Baseline	Correlation w/ PCL-R Factor 2	8	-
Deeley 2006		24	46	-	PCL-R	fMRI	Emotion processing	Fear > Baseline	Correlation w/ PCL-R Factor 1	1	+
		24	46	-	PCL-R	fMRI	Emotion processing	Fear > Baseline	Correlation w/ PCL-R Factor 2	0	+
		24	22	-	PCL-R	fMRI	Emotion processing	Sadness > Baseline	Controls > Psychopaths	10	-
		24	22	-	PCL-R	fMRI	Emotion processing	Sadness > Baseline	Psychopaths > Controls	5	+
		24	46	-	PCL-R	fMRI	Emotion processing	Sadness > Baseline	Correlation w/ PCL-R Factor 1	8	-
		24	46	-	PCL-R	fMRI	Emotion processing	Sadness > Baseline	Correlation w/ PCL-R Factor 2	7	-
		24	46	-	PCL-R	fMRI	Emotion processing	Sadness > Baseline	Correlation w/ PCL-R Factor 1	2	+
		24	46	-	PCL-R	fMRI	Emotion processing	Sadness > Baseline	Correlation w/ PCL-R Factor 2	0	+
		24	22	-	PCL-R	fMRI	Emotion processing	Pain > Baseline	Controls > Psychopaths	13	-
		24	22	-	PCL-R	fMRI	Emotion processing	Pain > Baseline	Psychopaths > Controls	2	+
Deeley 2006		24	46	-	PCL-R	fMRI	Emotion processing	Pain > Baseline	Correlation w/ PCL-R Factor 1	9	-
		24	46	-	PCL-R	fMRI	Emotion processing	Pain > Baseline	Correlation w/ PCL-R Factor 2	10	-
		24	46	-	PCL-R	fMRI	Emotion processing	Pain > Baseline	Correlation w/ PCL-R Factor 1	2	+
		24	46	-	PCL-R	fMRI	Emotion processing	Pain > Baseline	Correlation w/ PCL-R Factor 2	1	+
Deeley 2006		6	9	-	PCL-R	fMRI	Emotion processing	Fear > Neutral	Controls > Psychopaths	5	-
		6	9	-	PCL-R	fMRI	Emotion processing	Fear > Neutral	Psychopaths > Controls	0	+

		6	9	-	PCL-R	fMRI	Emotion processing	Happiness > Neutral	Controls > Psychopaths	4	-
		6	9	-	PCL-R	fMRI	Emotion processing	Happiness > Neutral	Psychopaths > Controls	0	+
Gordon 2004	-	-	-	10/10	PPI	fMRI	Emotion processing	Emotion > Baseline	Low > High EI Subscorers	3	-
		-	-	10/10	PPI	fMRI	Emotion processing	Emotion > Baseline	High > Low EI Subscorers	2	+
		-	-	10/10	PPI	fMRI	Recognition	Identity > Baseline	Low > High EI Subscorers	0	-
		-	-	10/10	PPI	fMRI	Recognition	Identity > Baseline	High > Low EI Subscorers	0	+
		-	-	10/10	PPI	fMRI	Emotion processing	Emotion > Baseline	Low > High SD Subscorers	0	-
		-	-	10/10	PPI	fMRI	Emotion processing	Emotion > Baseline	High > Low SD Subscorers	1	+
		-	-	10/10	PPI	fMRI	Recognition	Identity > Baseline	Low > High SD Subscorers	0	-
		-	-	10/10	PPI	fMRI	Recognition	Identity > Baseline	High > Low SD Subscorers	0	+
		-	-	10/10	PPI	fMRI	Emotion processing	Emotion > Baseline	Low > High PPI Scorers	1	-
		-	-	10/10	PPI	fMRI	Emotion processing	Emotion > Baseline	High > Low PPI Scorers	0	+
		-	-	10/10	PPI	fMRI	Recognition	Identity > Baseline	Low > High PPI Scorers	0	-
		-	-	10/10	PPI	fMRI	Recognition	Identity > Baseline	High > Low PPI Scorers	0	+
Gregory 2015	12	20	-	PCL-R	fMRI	Reinforcement processing	Punished > Rewarded	Psychopaths > Non-Psychopaths	9	+	
		12	-	18	PCL-R	fMRI	Reinforcement processing	Punished > Rewarded	Psychopaths > Non-Offenders	6	+
		12	20	-	PCL-R	fMRI	Reinforcement processing	Rewarded > Punished	Non-Psychopaths > Psychopaths	3	-
		12	-	18	PCL-R	fMRI	Reinforcement processing	Rewarded > Punished	Non-Offenders > Psychopaths	3	-
		12	20	-	PCL-R	fMRI	Reinforcement processing	Punished > Rewarded	Correlation w/ PCL-R	1	+
Han 2012	-	-	16/16	PPI-R	fMRI	Emotion processing	Fear Eyes-Removed > -Only	Low > High CT PPI Subscorers	9	-	
		-	-	16/16	PPI-R	fMRI	Emotion processing	Happiness Eyes-Only > -Removed	Low > High CT PPI Subscorers	4	-
		-	-	16/16	PPI-R	fMRI	Emotion processing	Fear > Neutral Whole Face	High > Low CT PPI Subscorers	1	+
		-	-	16/16	PPI-R	fMRI	Emotion processing	Anger > Neutral Whole Face	Low > High CT PPI Subscorers	1	-
Harenski 2010	16	16	-	PCL-R	fMRI	Moral processing	N/A	Non-Psychopaths > Psychopaths	0	-	
		16	16	-	PCL-R	fMRI	Moral processing	N/A	Psychopaths > Non-Psychopaths	1	+
		16	16	-	PCL-R	fMRI	Moral processing	Severity of moral violation ratings	Non-Psychopaths > Psychopaths	2	-
		16	16	-	PCL-R	fMRI	Moral processing	Severity of moral violation ratings	Psychopaths > Non-Psychopaths	0	+
Harenski 2014	-	-	157	PCL-R	fMRI	Moral processing	Moral+Non-Moral > Neutral	Correlation w/ PCL-R	0	+	
		-	-	157	PCL-R	fMRI	Moral processing	Moral+Non-Moral > Neutral	Correlation w/ PCL-R	5	-
		-	-	157	PCL-R	fMRI	Moral processing	Moral+Non-Moral > Neutral	Correlation w/ PCL-R Factor 1	0	+
		-	-	157	PCL-R	fMRI	Moral processing	Moral+Non-Moral > Neutral	Correlation w/ PCL-R Factor 1	0	-

		-	-	157	PCL-R	fMRI	Moral processing	Moral+Non-Moral > Neutral	Correlation w/ PCL-R Factor 2	0	+
		-	-	157	PCL-R	fMRI	Moral processing	Moral+Non-Moral > Neutral	Correlation w/ PCL-R Factor 2	6	-
		-	-	157	PCL-R	fMRI	Moral processing	Moral > Non-Moral	Correlation w/ PCL-R	0	+
		-	-	157	PCL-R	fMRI	Moral processing	Moral > Non-Moral	Correlation w/ PCL-R	5	-
		-	-	157	PCL-R	fMRI	Moral processing	Moral > Non-Moral	Correlation w/ PCL-R Factor 1	0	+
		-	-	157	PCL-R	fMRI	Moral processing	Moral > Non-Moral	Correlation w/ PCL-R Factor 1	1	-
		-	-	157	PCL-R	fMRI	Moral processing	Moral > Non-Moral	Correlation w/ PCL-R Factor 2	0	+
		-	-	157	PCL-R	fMRI	Moral processing	Moral > Non-Moral	Correlation w/ PCL-R Factor 2	0	-
Kiehl	2001	8	8	-	PCL-R	fMRI	Emotional processing	Emotional > Neutral	Psychopaths > Healthy Controls	2	+
		8	-	8	PCL-R	fMRI	Emotional processing	Emotional > Neutral	Psychopaths > Non-Psychopaths	2	+
Kiehl	2004	8	8	-	PCL-R	fMRI	Semantic processing	Abstract > Concrete	Controls > Psychopaths	2	-
Larson	2013	24	25	-	PCL-R	fMRI	Emotion processing	Early alternative focus	Non-Psychopaths > Psychopaths	1	-
		24	25	-	PCL-R	fMRI	Emotion processing	Early alternative focus	Psychopaths > Non-Psychopaths	3	+
Marsh	2014	-	-	16/16	PPI-R	fMRI	Emotion/Moral processing	Fear > Neutral	Low > High PPI-R Scorers	1	-
		-	-	16/16	PPI-R	fMRI	Emotion/Moral processing	Fear > Neutral	High > Low PPI-R Scorers	3	+
Meffert	2013	18	26	-	PCL-R	fMRI	Empathy processing	Emotion observation	Controls > Psychopaths	55	-
		18	26	-	PCL-R	fMRI	Empathy processing	Emotional empathy	Controls > Psychopaths	21	-
		18	26	-	PCL-R	fMRI	Empathy processing	Emotional empathy	Psychopaths > Controls	33	+
Mier	2014	11	18	-	PCL-R	fMRI	Face processing	Main Effect of Group	Controls > Psychopaths	1	-
		11	18	-	PCL-R	fMRI	Face processing	Main Effect of Group	Psychopaths > Controls	0	+
		11	18	-	PCL-R	fMRI	Face processing	Affective Theory of Mind	Controls > Psychopaths	2	-
		11	18	-	PCL-R	fMRI	Face processing	Affective Theory of Mind	Psychopaths > Controls	0	+
		11	18	-	PCL-R	fMRI	Face processing	Emotion recognition	Controls > Psychopaths	0	-
		11	18	-	PCL-R	fMRI	Face processing	Emotion recognition	Psychopaths > Controls	0	+
		11	18	-	PCL-R	fMRI	Face processing	Neutral face processing	Controls > Psychopaths	1	-
		11	18	-	PCL-R	fMRI	Face processing	Neutral face processing	Psychopaths > Controls	2	+
Müller	2003	6	6	-	PCL-R	fMRI	Emotional processing	Positive > Rest	Psychopaths > Controls	12	+
		6	6	-	PCL-R	fMRI	Emotional processing	Positive > Rest	Controls > Psychopaths	4	-
		6	6	-	PCL-R	fMRI	Emotional processing	Negative > Rest	Psychopaths > Controls	13	+
		6	6	-	PCL-R	fMRI	Emotional processing	Negative > Rest	Controls > Psychopaths	7	-
Müller	2008	10	12	-	PCL-R	fMRI	Cognitive/Emotional proc.	Negative > Rest	Controls > Psychopaths	9	-

Osumi	2012	-	-	20	PSPS	fMRI	Aggression processing	Unfair > Fair (Ultimatum + Dictator)	Correlation w/ PSPS	3	-
		-	-	20	PSPS	fMRI	Aggression processing	Unfair > Fair (Ultimatum - Dictator)	Correlation w/ PSPS	3	-
Pujol	2012	22	22	-	PCL-R	fMRI	Moral processing	Congruent > Incongruent	Controls > Psychopaths	1	-
		22	22	-	PCL-R	fMRI	Moral processing	Moral Dilemma > Control	Controls > Psychopaths	5	-
Rilling	2007	-	-	22	LSRP	fMRI	Social processing	Cooperation/Cooperation	Correlation w/ LSRP	3	+
		-	-	22	LSRP	fMRI	Social processing	Cooperation/Cooperation	Correlation w/ LSRP	4	-
		-	-	22	LSRP	fMRI	Social processing	Cooperation/Defection	Correlation w/ LSRP	1	+
		-	-	22	LSRP	fMRI	Social processing	Cooperation/Defection	Correlation w/ LSRP	1	-
		-	-	22	LSRP	fMRI	Social processing	Defection/Cooperation	Correlation w/ LSRP	1	+
		-	-	22	LSRP	fMRI	Social processing	Defection/Cooperation	Correlation w/ LSRP	8	-
		-	-	22	LSRP	fMRI	Social processing	Defection/Defection	Correlation w/ LSRP	5	+
		-	-	22	LSRP	fMRI	Social processing	Defection/Defection	Correlation w/ LSRP	0	-
		-	-	22	LSRP	fMRI	Social processing	Partner Confederation > Defection	Correlation w/ LSRP	1	+
		-	-	22	LSRP	fMRI	Social processing	Partner Confederation > Defection	Correlation w/ LSRP	5	-
		-	-	22	LSRP	fMRI	Social processing	Subject Confederation > Defection	Correlation w/ LSRP	1	+
		-	-	22	LSRP	fMRI	Social processing	Subject Confederation > Defection	Correlation w/ LSRP	5	-
Rodman	2016	-	-	46	PCL-R	fMRI	Response inhibition	Interference Suppression	Correlation w/ PCL-R	4	+
		-	-	46	PCL-R	fMRI	Response inhibition	Response Inhibition	Correlation w/ PCL-R	2	+
Sadeh	2013	-	-	49	FFI	fMRI	Emotional Stroop	Positive > Neutral	Correlation w/ FD Facet	2	+
		-	-	49	FFI	fMRI	Emotional Stroop	Negative > Neutral	Correlation w/ FD Facet	0	+
		-	-	49	FFI	fMRI	Emotional Stroop	Positive > Neutral	Correlation w/ IA Facet	6	+
		-	-	49	FFI	fMRI	Emotional Stroop	Negative > Neutral	Correlation w/ IA Facet	6	+
Schultz	2016	31	19	-	PCL-R	fMRI	Fear conditioning	Conditional+ > Conditional- Stimulus	Psychopaths > Non-Psychopaths	14	+
Sommer	2010	14	14	-	PCL-R	fMRI	Theory of Mind	Mentalizing > Reality	Psychopaths > Non-Psychopaths	1	+
		14	14	-	PCL-R	fMRI	Theory of Mind	Mentalizing (Unfulfilled) > Reality	Psychopaths > Non-Psychopaths	2	+
Yoder	2015	-	-	43	PPI-R	fMRI	Violence stimulation	Martial Arts > Capoeira Videos	Correlation w/ PPI-R Factor FD	1	+
		-	-	43	PPI-R	fMRI	Violence stimulation	Martial Arts > Capoeira Videos	Correlation w/ PPI-R Factor FD	1	-
		-	-	43	PPI-R	fMRI	Violence stimulation	Martial Arts > Capoeira Videos	Correlation w/ PPI-R Factor SCI	2	+
		-	-	43	PPI-R	fMRI	Violence stimulation	Martial Arts > Capoeira Videos	Correlation w/ PPI-R Factor SCI	0	-
		-	-	43	PPI-R	fMRI	Violence stimulation	Martial Arts > Capoeira Videos	Correlation w/ PPI-R Factor CH	4	+
		-	-	43	PPI-R	fMRI	Violence stimulation	Martial Arts > Capoeira Videos	Correlation w/ PPI-R Factor CH	0	-

Yoder	2015	28	32	-	PCL-R	fMRI	Moral processing	Bad > Good (Implicit Judgment)	Controls > Psychopaths	4	-
		28	32	-	PCL-R	fMRI	Moral processing	Bad > Good (Implicit Judgment)	Psychopaths > Controls	3	+
		28	32	-	PCL-R	fMRI	Moral processing	Bad > Good (Implicit Judgment)	Controls > Psychopaths	10	-
		28	32	-	PCL-R	fMRI	Moral processing	Bad > Good (Implicit Judgment)	Psychopaths > Controls	3	+

Subjects groups comprised psychopaths and matched controls as well as other samples from the community (Gregory et al., 2015; Han et al., 2012; Sadeh et al., 2013; Yoder et al., 2015b), university community (Gordon et al., 2004; Marsh et al., 2014; Osumi et al., 2012; Rilling et al., 2007), and correctional institutions (Caldwell et al., 2015; Cope et al., 2014; Harenski et al., 2014; Kiehl et al., 2001; Rodman et al., 2016).

CH, Cold Heartedness; CT, Callous Traits; EI, Emotional-Interpersonal; FD, Fearless-Dominance; FFI, Five Factor Inventory (Costa and McCrae, 1992); fMRI, functional magnetic resonance imaging; IA, Impulsive-Antisociality; LSRP, Levenson Self-Report Psychopathy Scale (Levenson et al., 1995); PCL-R, Psychopathy Check List (Hare, 1998); PPI, Psychopathic Personality Inventory (Lilienfeld and Andrews, 1996); PPI-R, Psychopathic Personality Inventory-Revised (Lilienfeld et al., 2005); PSPS, Primary and Secondary Psychopathy Scales (Osumi et al., 2007); SCI, Self-Centered Impulsivity; SD, Socially Deviant.

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