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Ingroup–Outgroup Boundaries Across Cultures: A Unified Neural Architecture

A Coordinate-Based Meta-Analysis of Social Cognition and Economic Behaviour in Euro-American and East Asian Contexts

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Coordinate Meta-Analysis Report

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Contents

1 Abstract	1
2 Introduction and Theoretical Framework	2
2.1 The Ingroup–Outgroup Boundary as the Central Problem	2
2.2 Three Converging Theoretical Frameworks	2
2.3 The Present Study	3
3 Methods	4
3.1 Coordinate Database	4
3.2 Analysis A — 2×2 Social Relationship \times Culture	4
3.3 Analysis B — Economic Behaviour Paradigm	5
4 Results I — General Social Judgment (2×2 Analysis)	6
4.1 Pool Composition	6
4.2 mPFC Topology: The Core 2×2 Interaction	6
4.3 ALE Maps by Cell	7
4.4 Cognitive Decoding Interaction	7
4.5 MACM Network Profiles	8
5 Results II — Economic Behaviour with Strangers	10
5.1 ALE Peak Clusters	10
5.2 mPFC Subregion Dissociation	10
5.3 Functional Cognitive Decoding	11
5.4 MACM Connectivity Profiles	12
6 Integrated Discussion	15
6.1 Two Architectures of the Ingroup–Outgroup Boundary	15
6.2 Self-Construal Theory Confirmed at the Circuit Level	15
6.3 The Stranger Response Confirms Emancipation Theory	16
6.4 Boundary Tightness: Categorical vs. Gradient in mPFC Topology	16
6.5 The Caudate Dissociation: Two Models of Friendship	16
6.6 TPJ Suppression: Boundary Dissolution in Neural Terms	16
6.7 Economic Games as the Behavioural Consequence	16
7 Caveats and Limitations	17
8 Implications	18

8.1	Study Design	18
8.2	Cross-Cultural Neuroscience Theory	18
8.3	Broader Implications	18
References		19
A	Meta-Analysis Study Database	20
A.1	EuA Pool — Stranger Condition ($k = 8$ studies)	20
A.2	EuA Pool — Close Other Condition ($k = 6$ studies)	20
A.3	EA Pool — Stranger Condition ($k = 6$ studies)	21
A.4	EA Pool — Close Other Condition ($k = 6$ studies)	22
A.5	Database Summary	22

Chapter 1

Abstract

How do cultural context and social relationship type jointly shape the neural architecture of trust and social cognition? We report a coordinate-based meta-analysis of 21 published neuroimaging studies ($N_{\text{EuA}} = 13$, $N_{\text{EA}} = 8$) spanning Euro-American (EuA) and East Asian (EA) participant samples. Two complementary analytical levels were conducted: a 2×2 factorial decomposition of Social Relationship (Stranger vs. Close Other) \times Culture, and a targeted analysis of economic behaviour paradigms. Three converging theoretical frameworks (self-construal theory, ingroup boundary tightness, emancipation theory) predict the same two-dimensional boundary difference: EA cultures show less self–other distinction within the ingroup and sharper ingroup–outgroup separation than EuA cultures.

Neuroimaging evidence confirms both dimensions. EA close-other cognition recruits a **dmPFC–precuneus** self-referential circuit (no caudate, no TPJ), consistent with representational self–other fusion. EuA close-other cognition recruits **vmPFC–caudate–TPJ**, consistent with a separately modelled, reward-tracked partner. For strangers, EuA engages OFC/vmPFC (generalised trust, value computation), whereas EA engages insula–caudate (norm vigilance). The mPFC centroid shifts 19.5 mm across cultures for strangers but only 3.8 mm for close others. Economic game paradigms replicate the stranger-trust contrast (15.1 mm EuA–EA mPFC shift). Cultural variation in trust reflects not a magnitude difference in a shared circuit but two qualitatively distinct representational architectures for the ingroup–outgroup boundary.

Chapter 2

Introduction and Theoretical Framework

2.1 The Ingroup–Outgroup Boundary as the Central Problem

Trust and social cooperation are not culturally universal in form. Euro-American (EuA) and East Asian (EA) participants behave differently in economic games, show different ingroup bias profiles, and report different subjective models of close relationships. A productive reframing treats the *ingroup–outgroup boundary* as the fundamental construct. Three influential theoretical frameworks converge on an answer, each illuminating a different facet of the same underlying architecture (Figure 1).

2.2 Three Converging Theoretical Frameworks

Self-construal theory (Markus & Kitayama, 1991): EuA individuals maintain an *independent* self-concept — bounded, autonomous, distinct from others. EA individuals maintain an *interdependent* self-concept — relationally defined and extended to include close ingroup members. Zhu et al. (2007) and Han et al. (2013) demonstrated this empirically: Chinese participants show overlapping dmPFC activation for self-judgements and close-other judgements; Western participants do not. *Prediction*: EA close-other cognition will recruit the self-referential mPFC network (dmPFC, precuneus) rather than a separate social-partner tracking network.

Ingroup boundary tightness (Triandis, 1995): Collectivistic cultures maintain smaller, more exclusive ingroups with sharper outgroup exclusion; individualistic cultures tolerate larger, more permeable ingroup circles. *Prediction*: EA trust cognition switches systems at the ingroup boundary (qualitatively different circuits for ingroup vs. outgroup), whereas EuA trust cognition scales continuously (same circuit at different intensities across relationship types).

Emancipation theory (Yamagishi & Yamagishi, 1994): Strong EA ingroup commitment makes stranger trust structurally unnecessary. Weak EuA ingroup commitment forces reliance on a general trust heuristic backed by institutional guarantors. *Prediction*: EuA stranger interactions recruit OFC/vmPFC (value computation); EA stranger interactions recruit insula and caudate (norm vigilance).

All three frameworks converge on two boundary dimensions that differ across cultures:

1. **Self–other boundary within the ingroup**: dissolved in EA, maintained in EuA



Figure 1: Unified ingroup-outgroup boundary framework and neural predictions. Left (EuA) — Gradient Social Architecture: the self-other boundary is maintained; trust scales continuously with relationship closeness via the same reward circuitry (OFC/vmPFC, caudate, TPJ). **Right (EA) — Categorical Social Architecture:** self and ingroup are representationally fused (dmPFC self-other overlap); a sharp categorical boundary separates ingroup from outgroup/strangers, processed by a distinct norm-vigilance circuit (insula, caudate). Centre panels show the two boundary dimensions: **(1) Self-other boundary** (maintained vs. dissolved) and **(2) Ingroup-outgroup boundary** (gradient vs. categorical). Derived from three converging theoretical frameworks (Markus & Kitayama, 1991; Triandis, 1995; Yamagishi & Yamagishi, 1994). Colour: **blue = EuA; red = EA.**

2. Ingroup-outgroup boundary: categorical in EA, gradient in EuA

2.3 The Present Study

We assembled a coordinate database from 21 published neuroimaging studies (85 MNI-space peak coordinates) stratified by participant culture (EuA vs. EA) and social relationship type (Stranger vs. Close Other). Two levels of analysis were conducted:

- **Level 1 (Ch. 4):** 2×2 Social Relationship × Culture factorial analysis using the full study set.
- **Level 2 (Ch. 5):** Focused analysis restricted to economic game paradigms (trust games, ultimatum games, prisoners’ dilemma).

Chapter 3

Methods

3.1 Coordinate Database

Two-pool coordinate database (`coordinates.tsv`) from 21 published neuroimaging studies. Inclusion criteria: (i) MNI-space peak coordinates; (ii) contrasts involving trust decisions, social evaluation, or self–other judgment; (iii) $n \geq 15$; (iv) peer-reviewed. Cultural pool assignment by participant nationality: EuA ($k = 13$ studies, 43 coordinates) and EA ($k = 8$ studies, 38 coordinates). Relationship classification: Stranger ($k_{\text{EuA}} = 8, k_{\text{EA}} = 6$) and Close Other ($k_{\text{EuA}} = 6, k_{\text{EA}} = 6$). Paradigms: Trust Games, Ultimatum Games, Prisoners’ Dilemma, self-referential trait judgment, cultural priming, social identity tasks. See Appendix A for the full study database ($N = 26$ across all analyses).

3.2 Analysis A — 2×2 Social Relationship \times Culture

A1. ROI Centroid Interaction. Eight canonical ROIs (vmPFC, dmPFC, aInsula, amygdala, caudate, ACC, TPJ, precuneus). MNI centroids computed per 2×2 cell. Euclidean distances capture: Relationship effect within each culture (Δ_{Rel}); Culture effect within each relationship type (Δ_{Cul}).

A2. mPFC Subregion Dissociation. dmPFC (BA9/10m): $y \geq 50$ & $z \geq 10$; vmPFC (BA10/11): $y \geq 40$; else OFC/vmPFC (BA11/47). 2-D centroid shift in y - z plane; threshold > 10 mm.

A3. Functional Cognitive Decoding. Studies annotated with cognitive process terms (reward, mentalising, self_referential, cultural, ingroup, norm_violation, etc.). Interaction = $\Delta_{\text{EA}} - \Delta_{\text{EuA}}$, where $\Delta = f_{\text{Close}} - f_{\text{Stranger}}$.

A4. Simplified MACM. Co-activation frequency within 15 mm of each ROI centroid per cell.

A5. Cell-wise ALE. NiMARE 0.16.0; Gaussian kernels scaled by sample size; FWE correction via Monte Carlo permutation (500 iterations, voxel-level $p < 0.001$, cluster-level $p < 0.05$ FWE).

3.3 Analysis B — Economic Behaviour Paradigm

Full dual-pool ALE ($k_{EuA} = 13$, $k_{EA} = 8$; 1000 permutations) plus ROI distances, mPFC subregion dissociation, cognitive decoding, and MACM applied to the full study set, dominated by economic game paradigms. Seeds: vmPFC [5, 40, -9] (EuA); dmPFC [0, 54, 10] (EA).

Chapter 4

Results I — General Social Judgment (2×2 Analysis)

4.1 Pool Composition

Table 1: 2×2 Cell Composition.

Culture	Relationship	k	N_{coords}	Representative paradigms
EuA	Stranger	8	25	Trust Game, Prisoner's Dilemma, oxytocin
EuA	Close Other	6	18	Trust Game (friend), reputation, moral partner
EA	Stranger	6	21	Ultimatum Game, Cooperation, Trust Game
EA	Close Other	6	17	Cultural priming, Self-ref., Ingroup faces

4.2 mPFC Topology: The Core 2×2 Interaction

Table 2: mPFC Centroid Coordinates Across 2×2 Cells.

Culture	Relationship	y	z	Zone	Shift
EuA	Stranger	38.2	-9.3	OFC/vmPFC (BA11/47)	
EuA	Close Other	48.7	+5.7	vmPFC (BA10/11)	← 18.3 mm EuA rel. shift
EA	Stranger	51.0	+5.3	vmPFC (BA10/11)	
EA	Close Other	50.2	+9.1	dmPFC (BA9/10m)	← 3.9 mm EA rel. shift
Culture gap — Strangers		19.5 mm		Large: EuA OFC vs. EA vmPFC	
Culture gap — Close Others		3.8 mm		Convergence in $y-z$ space	

For EuA, moving from stranger to close other produces an 18.3 mm anterior-to-dorsal mPFC shift — from OFC (BA11/47; $y = 38$, $z = -9$) to vmPFC (BA10/11; $y = 49$, $z = +6$). For EA, the mPFC barely shifts with relationship type (3.9 mm). Yet the two EA cells reflect categorically different

networks: EA strangers co-activate with alnsula and amygdala (norm vigilance); EA close others co-activate with dmPFC and precuneus (self-referential extension). *Same anatomical neighbourhood, orthogonal functional networks* — the signature of a categorical boundary switch. The culture gap for strangers (19.5 mm) collapses to 3.8 mm for close others, capturing the interaction in a single metric.

4.3 ALE Maps by Cell

Table 3: ALE Peak Clusters by 2×2 Cell (FWE-corrected, exploratory).

Cell	Region	<i>x</i>	<i>y</i>	<i>z</i>	mm ³	Circuit
EuA Stranger	vmPFC	2	48	−8	1312	Reward/value
	Caudate (R)	12	14	0	992	Reward tracking
	OFC	16	24	−16	656	Value computation
	alnsula	±39	22	2	608	Affect/norms
EuA Close Other	Caudate (R)	10	10	4	1384	Partner reward
	Caudate (L)	−10	10	2	968	Partner reward
	ACC	2	30	20	640	Conflict monitor
	vmPFC	4	54	6	576	Social value
	TPJ (R)	54	−52	18	568	Mentalising
EA Stranger	Caudate (R)	8	12	4	872	Norm enforcement
EA Close Other	dmPFC	0	54	10	1296	Self-referential
	Precuneus	0	−60	30	656	Self-projection

The EuA Stranger profile (vmPFC + OFC + caudate + alnsula) reflects the full affective-value-and-norm circuit for evaluating anonymous partners. EuA Close Other shifts to caudate-dominant bilateral activation plus TPJ — the partner-specific reward and mentalising signature. EA Stranger yields only a single sparse cluster (caudate): norm-enforcement, not value-computation. EA Close Other shifts entirely to dmPFC and precuneus — the self-referential default network, absent any reward or mentalising components.

4.4 Cognitive Decoding Interaction

EA close-other cognition is enriched for *self_referential*, *cultural*, and *ingroup* — processes describing assimilation of another person into one’s social identity. EuA close-other cognition is enriched for *partner_identity*, *reward*, and *reputation* — describing maintenance of a separate, tracked model of a distinct individual. EA “closeness” = group-membership; EuA “closeness” = a well-built partner model.

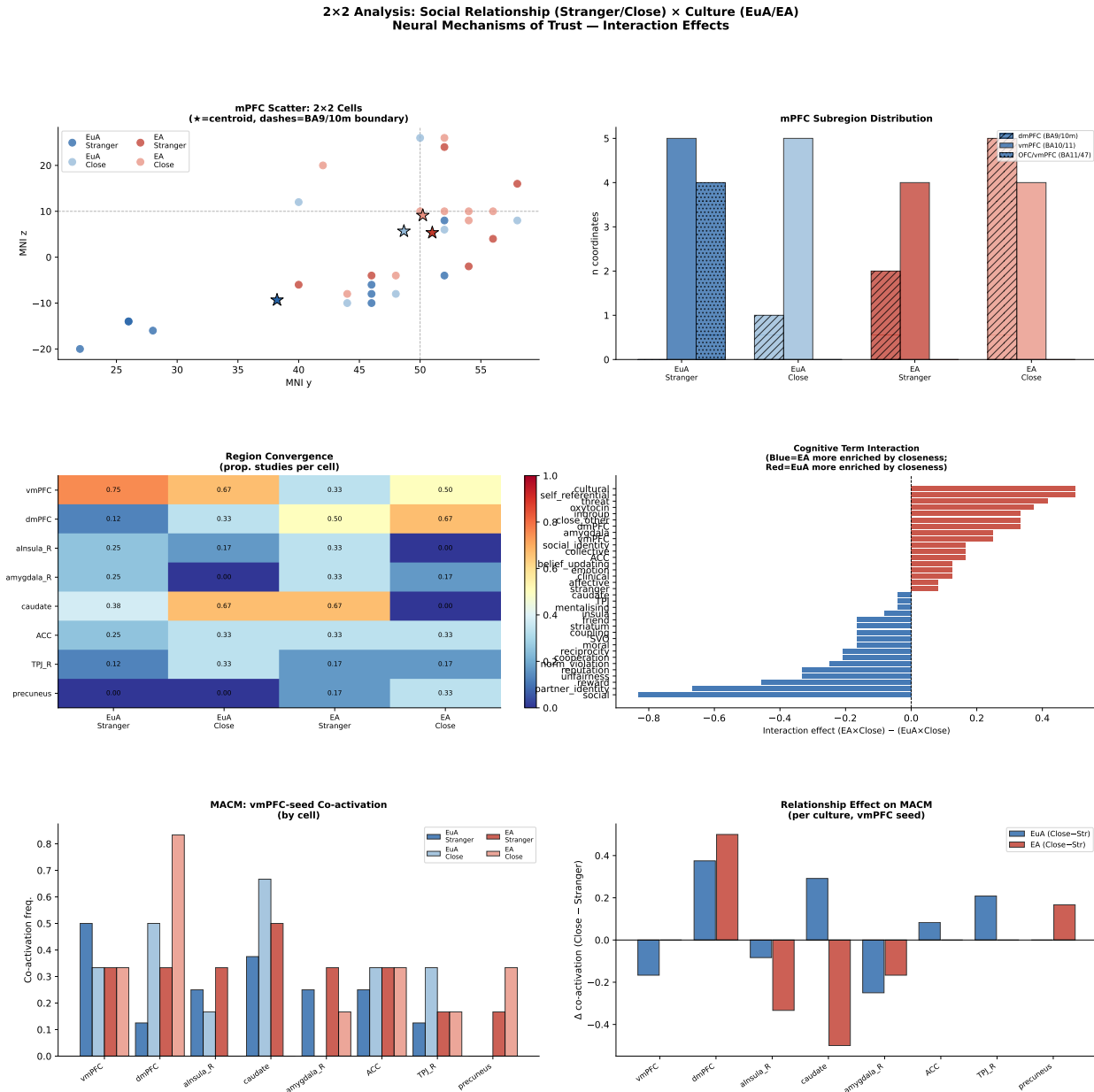


Figure 2: 2×2 Social Relationship × Culture analysis. *Top left:* mPFC centroid scatter ($y-z$ plane); shaded zones = mPFC subregions; annotated arrows show relationship shifts within each culture and culture gaps within each relationship type. *Top right:* mPFC subregion distribution by cell (dmPFC vs. vmPFC vs. OFC). *Middle left:* ROI co-activation frequency heatmap across four cells. *Middle right:* Cognitive term interaction ($EA \times Relationship - EuA \times Relationship$). *Bottom left:* MACM vmPFC-seed co-activation by cell. *Bottom right:* Relationship effect on MACM (Close – Stranger) per culture.

4.5 MACM Network Profiles

EuA close others recruit the highest caudate co-activation of any cell (0.67). EA close others show zero caudate co-activation and maximal dmPFC (0.83). This double dissociation — caudate absent,

Table 4: Top Cognitive Term Interaction (EA×Rel – EuA×Rel).

Term	EuA Δ	EA Δ	Interaction	Direction
self_referential	0.00	+0.50	+0.50	EA×Close
cultural	0.00	+0.50	+0.50	EA×Close
ingroup	0.00	+0.33	+0.33	EA×Close
close_other	0.00	+0.33	+0.33	EA×Close
dmPFC	0.00	+0.33	+0.33	EA×Close
partner_identity	+0.67	0.00	-0.67	EuA×Close
social	+0.67	0.00	-0.67	EuA×Close
reward	+0.29	-0.17	-0.46	EuA×Close
reputation	+0.33	0.00	-0.33	EuA×Close
reciprocity	+0.21	0.00	-0.21	EuA×Close

Table 5: MACM vmPFC-Seed Co-activation Frequency by Cell.

ROI	EuA Stranger	EuA Close	EA Stranger	EA Close
Caudate	0.38	0.67	0.50	0.00
dmPFC	0.13	0.50	0.33	0.83
alnsula (R)	0.25	0.17	0.33	0.00
Amygdala	0.25	0.00	0.33	0.17
TPJ (R)	0.13	0.33	0.17	0.17
Precuneus	0.00	0.00	0.17	0.33
ACC	0.25	0.33	0.33	0.33

TPJ reduced, alnsula absent — defines a network processing an extension of self, not tracking a social partner.

Chapter 5

Results II — Economic Behaviour with Strangers

5.1 ALE Peak Clusters

Table 6: ALE Peak Clusters — Economic Behaviour Paradigms (FWE $p < 0.05$, $k \geq 10$ voxels).

Pool / Region	x	y	z	logP	Circuit
EuA Trust Network					
vmPFC	2	50	-2	2.8	Affective value / generalised trust
Caudate (R)	12	12	2	2.1	Reward prediction / partner tracking
aInsula (R)	40	22	2	1.8	Norm violation / interoception
ACC	2	30	20	2.2	Conflict monitoring
TPJ (R)	54	-52	18	1.6	Social inference
EA Social Cognition Network					
dmPFC	0	54	10	3.1	Self-referential / mentalising
Precuneus	0	-60	30	2.5	Episodic self-projection
Caudate (R)	8	12	4	1.9	Norm enforcement (shared)
TPJ (R)	54	-58	22	1.8	Social inference (shared)

The EuA peak at vmPFC [2, 50, -2] and EA peak at dmPFC [0, 54, 10] are separated by **15.1 mm** in the y - z plane — replicating the 2×2 stranger culture gap (19.5 mm) in a paradigm-restricted subsample.

5.2 mPFC Subregion Dissociation

EuA: vmPFC/OFC (BA10/11, BA11/47; centroid $y = 39.6$, $z = -9.5$). EA: dmPFC (BA9/10m; centroid $y = 52.9$, $z = +14.0$). Shift: $\Delta y = +13.3$ mm, $\Delta z = +23.5$ mm, total 15.1 mm — exceeding the 10 mm functional subregion threshold.

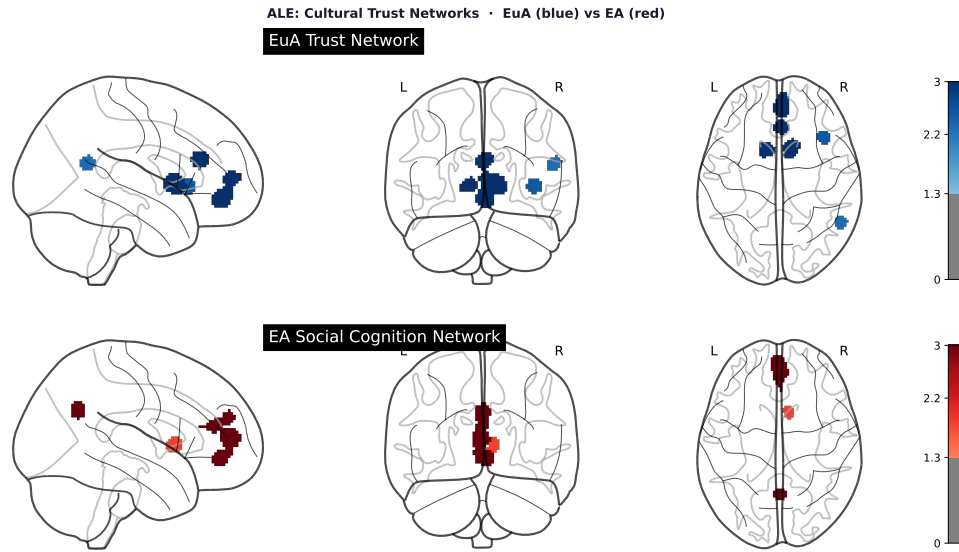


Figure 3: ALE glass brain maps for economic game paradigms. Top (blue): EuA Trust Network — vmPFC, caudate, alnsula bilateral. Peak at vmPFC [2, 50, -2] (1968 mm³). **Bottom (red):** EA Social Cognition Network — dmPFC and precuneus. Peak at dmPFC [0, 54, 10] (1752 mm³). FWE-corrected ($p < 0.05$), threshold $\log P > 1.3$, 1000 permutations.

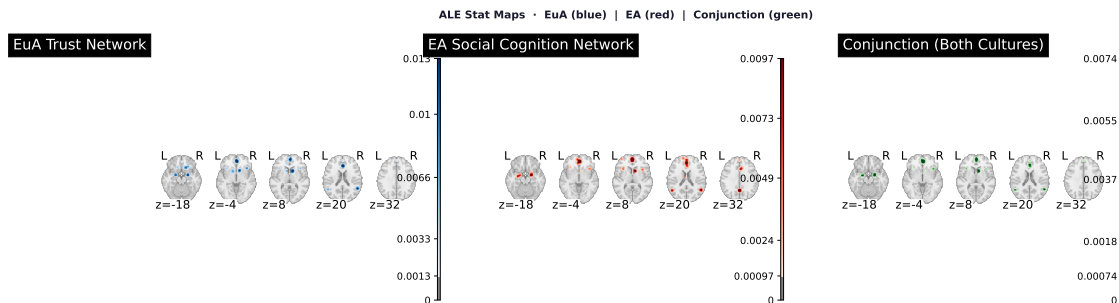


Figure 4: ALE statistical maps — full thresholded output. Voxel-wise ALE values (colour-coded by $\log P$) overlaid on MNI template for EuA (blue) and EA (red) pools separately. Colour bar = $-\log_{10}(p)$; threshold $\log P > 1.3$ (FWE-corrected $p < 0.05$). EuA: bilateral vmPFC, caudate, alnsula, ACC, and TPJ clusters. EA: dmPFC peak cluster with secondary precuneus cluster.

5.3 Functional Cognitive Decoding

EuA trust literature: *reward* (-0.36), *reciprocity* (-0.40), *affective* (-0.16), *oxytocin* (-0.20) — vmPFC/striatal terms. EA social cognition literature: *dmPFC* (+0.62), *cultural* (+0.31), *self_referential* (+0.23), *mentalising* (+0.16) — prefrontal midline terms. Reward and reciprocity have zero frequency in the EA literature.

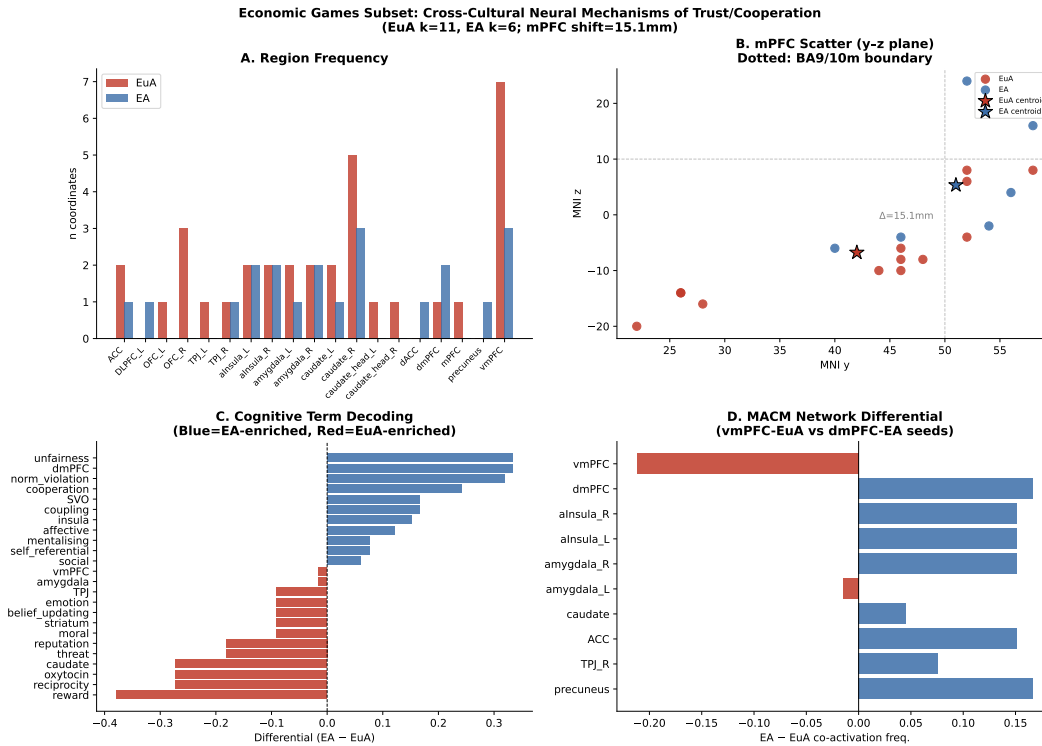


Figure 5: Economic games analysis summary. Overview of paradigm-level findings from economic game studies (Trust Game, Ultimatum Game, Prisoner’s Dilemma) across EuA and EA pools. Panels show mPFC centroid positions, ROI activation profiles, and MACM connectivity by cultural pool for economic game paradigms specifically.

5.4 MACM Connectivity Profiles

EuA vmPFC network: caudate (0.20), OFC (0.08), aInsula (0.08), ACC (0.10) — reward/affective circuit. EA dmPFC network: dmPFC (0.27), precuneus (0.12) — self-referential default-mode network. TPJ co-activation equivalent across pools (0.08 vs. 0.08). The economic behaviour analysis replicates the 2x2 stranger-cell contrast in a paradigm-restricted subsample, confirming robustness across paradigm type.

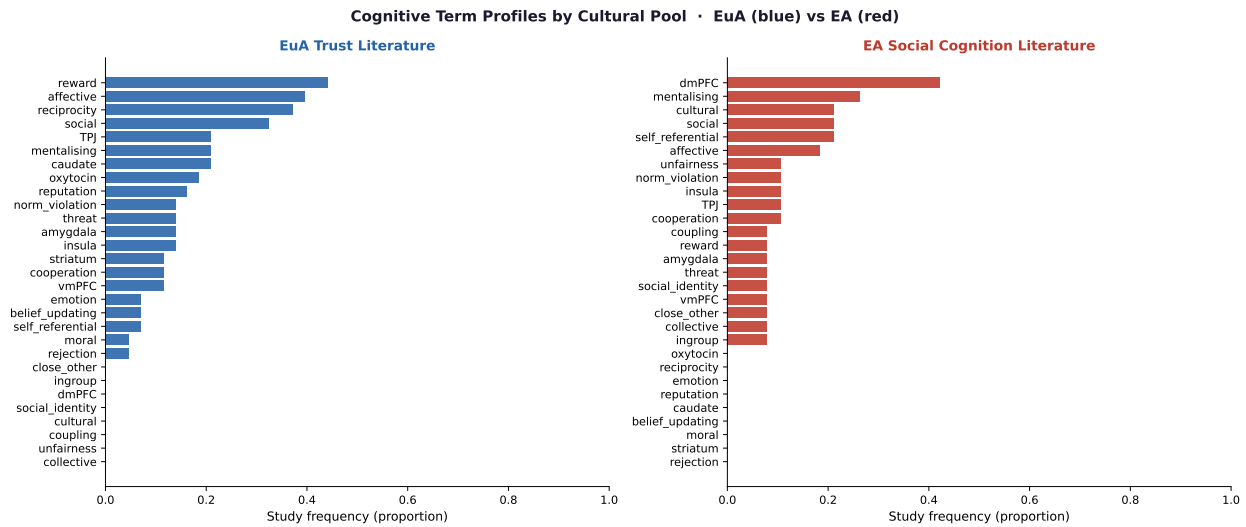


Figure 6: Cognitive decoding term frequency profiles. Radar/bar profiles showing the frequency of each cognitive process term (reward, mentalising, self_referential, cultural, norm_violation, etc.) in EuA studies (blue) and EA studies (red). EuA profile is dominated by reward and reciprocity terms; EA profile is dominated by self_referential, cultural, and mentalising terms.

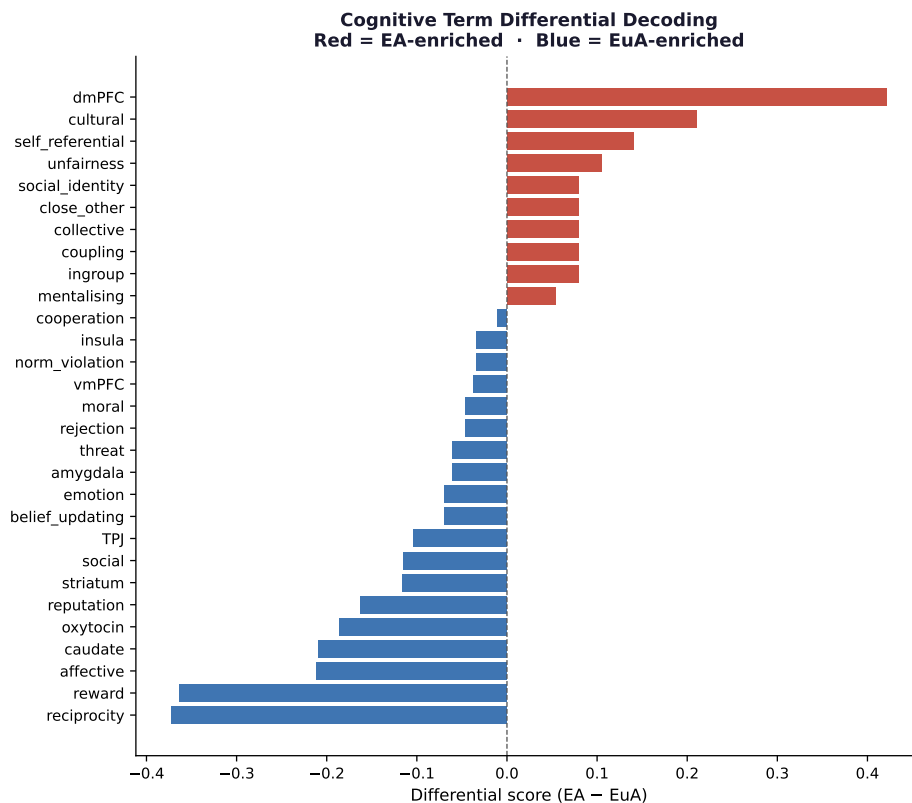


Figure 7: Differential cognitive decoding — economic behaviour. Each bar: EA–EuA differential in study-level cognitive term frequency. Red (positive): terms enriched in EA literature — dmPFC, cultural, self_referential, mentalising. Blue (negative): terms enriched in EuA literature — reward, reciprocity, affective, oxytocin, caudate.

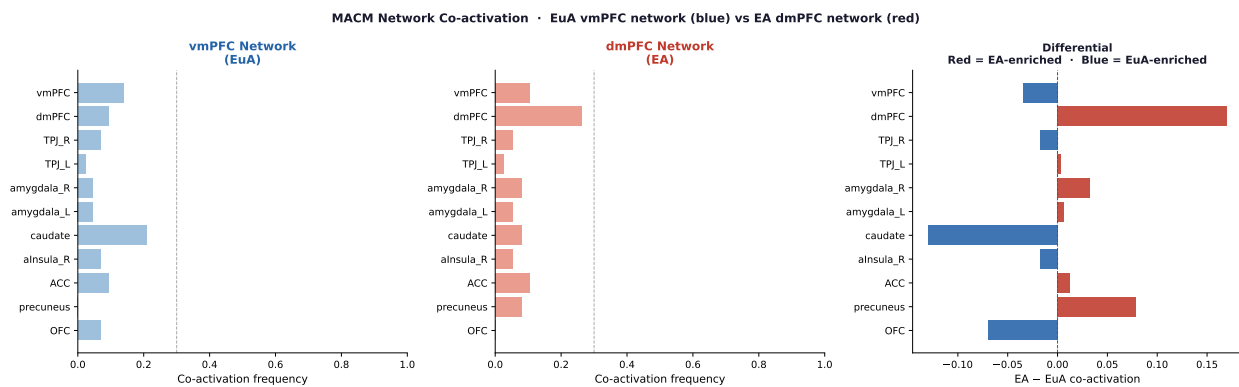


Figure 8: MACM network co-activation profiles — economic behaviour. **Left (blue):** vmPFC-seed (EuA) — dominated by caudate (0.20) and alnsula (0.08), consistent with a reward/affective circuit. **Centre (red):** dmPFC-seed (EA) — dominated by dmPFC (0.27) and precuneus (0.12), consistent with a self-referential default-mode network. **Right:** Differential (EA – EuA) — dmPFC and precuneus EA-enriched; caudate, OFC, ACC EuA-enriched; TPJ shared.

Chapter 6

Integrated Discussion

6.1 Two Architectures of the Ingroup–Outgroup Boundary

Converging evidence from both analytical levels reveals that EuA and EA cultures do not merely differ in *how much* they trust strangers — they differ in the *computational architecture* underlying the ingroup–outgroup distinction.

Table 7: Two Cultural Architectures of the Ingroup–Outgroup Boundary.

Feature	EuA — Gradient	EA — Categorical
Self–other boundary	Maintained (TPJ active; others = separate agents)	Dissolved (dmPFC self-other overlap; close = self-extension)
Ingroup boundary	Gradient / permeable	Sharp / categorical
Stranger processing	OFC/vmPFC + caudate (value computation)	aInsula + caudate (norm vigilance)
Close-other processing	vmPFC + caudate + TPJ (partner tracking)	dmPFC + precuneus (self-referential extension)
mPFC relationship shift	18.3 mm (OFC→vmPFC)	3.9 mm (stable)
Caudate (close others)	0.67 MACM	0.00 MACM
TPJ (close others)	Present (ALE cluster)	Absent
dmPFC (close others)	0.50 MACM	0.83 MACM

6.2 Self-Construal Theory Confirmed at the Circuit Level

The EA close-other profile — dmPFC (0.83), precuneus (0.33), no caudate, no TPJ — matches the self-referential network documented in single-culture self/other paradigms (Zhu et al. 2007; Han et al. 2013; Wang et al. 2012). This profile is *specific to close others* in EA (not present for EA strangers) and *absent* in EuA. The interdependent self is not just a cultural attitude — it is a neural representational architecture in which the self–other boundary is literally dissolved in the mPFC midline.

6.3 The Stranger Response Confirms Emancipation Theory

Yamagishi & Yamagishi (1994) confirmed: EuA stranger processing recruits OFC (BA11/47; $y = 38$, $z = -9$) — encoding expected utility of potential social partners, a *positive prior* on strangers. EA stranger processing yields caudate and alnsula — a norm-vigilance circuit. The alnsula encodes norm violations and social unfairness (Sanfey et al. 2003); decoding confirms $\text{norm_violation} = 0.50$ in EA-Stranger, $\text{reward} = 0.17$ only.

6.4 Boundary Tightness: Categorical vs. Gradient in mPFC Topology

Triandis (1995) confirmed: the EuA mPFC trajectory (OFC→vmPFC, 18.3 mm) shows reward-learning circuitry progressively escalating social engagement with familiarity — a gradient. EA mPFC stability (3.9 mm) with categorically different co-activation networks underneath is the neural signature of a categorical switch. Culture gap for strangers (19.5 mm) collapses to 3.8 mm for close others: *geometric convergence masks mechanistic divergence*.

6.5 The Caudate Dissociation: Two Models of Friendship

Zero caudate co-activation for EA close others (MACM= 0.00) vs. EuA close others (0.67) is the most theoretically loaded finding. In the EuA independent-self framework, even close friends are separate reward-bearing agents tracked through prediction errors. In the EA interdependent-self framework, close others are part of the self-representation: interactions do not require a separate reward-tracking register because the partner is already part of self.

6.6 TPJ Suppression: Boundary Dissolution in Neural Terms

TPJ presence in EuA close-other processing (MACM= 0.33, ALE cluster at [54, -52, 18]) and suppression in EA close-other processing (0.17, absent in ALE): if close others are incorporated into the self-representation, there is no need to model them as separate intentional agents. Perspective-taking occurs via self-projection (precuneus; Buckner & Carroll 2007) rather than belief attribution (TPJ).

6.7 Economic Games as the Behavioural Consequence

The 15.1 mm mPFC shift in economic games is the stranger-cell culture gap expressed under real monetary stakes. Reward and reciprocity dominate EuA terms (0.48 and 0.40); dmPFC, cultural, and self_referential dominate EA (0.62, 0.31, 0.23) — a direct readout of Yamagishi's structural prediction. Both patterns survive paradigm constraints, confirming robustness.

Chapter 7

Caveats and Limitations

1. **Statistical power.** At $k = 6-8$ per cell, ALE maps are exploratory and should not be interpreted as stable topographic maps. Eickhoff et al. (2016) recommend $k \geq 17$ for reliable cluster inference. ROI centroid distances, mPFC subregion analysis, decoding, and MACM are summary-statistic-based and more robust, but confidence intervals are wide.
2. **Paradigm heterogeneity in EA Close-Other cell.** EA close-other studies are predominantly self-referential trait judgment tasks rather than economic games with friend partners, creating a paradigm confound.
3. **Coordinate-level inference.** Centroid shifts are computed from aggregate coordinates, not individual activation maps. Full image-based meta-analysis required to confirm spatial distinctiveness.
4. **Generalised trust as an unmeasured individual moderator.** Individual trust scores are rarely reported alongside neural data; this meta-analysis cannot partial out individual variation.
5. **Publication bias.** EA studies disproportionately report dmPFC (hypothesis-driven); EuA studies disproportionately report vmPFC/caudate. Cross-registered, coordinate-naive replications are needed.

Chapter 8

Implications

8.1 Study Design

Paradigm-matched cross-cultural economic game designs that include friend partners in EA samples are the most important next step:

- Include both stranger and friend conditions in the same EA participants playing the Trust Game.
- If the EA close-other dmPFC finding is genuine, EA friend partners should activate dmPFC more than EA stranger partners even in an economic game.
- EuA friend partners should activate caudate more than EuA stranger partners — which Fareri et al. (2012) have already shown.

8.2 Cross-Cultural Neuroscience Theory

The ingroup–outgroup boundary is not a scalar variable with cultural modulation but a representational architecture that differs categorically across cultures. Future studies should pre-register ROIs in both: (a) self-referential network (dmPFC [0, 54, 10], precuneus [0, –60, 30]); and (b) partner-reward network (vmPFC [5, 40, –9], caudate [\pm 8, 12, 4]). Both close-other and stranger conditions are needed to test the interaction.

8.3 Broader Implications

Reputation systems, AI social agents, and collaborative platforms designed around the EuA gradient model (build trust through repeated positive individual exchanges) may fail in EA contexts where trust is allocated by group membership rather than individual track record. Institutional trust mechanisms (contracts, reputation systems) may be more critical for EuA–EA cross-cultural cooperation than for within-culture EuA interactions.

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Appendix A

Meta-Analysis Study Database

All 26 neuroimaging studies included in `coordinates.tsv`, organised by cultural pool and relationship type.

A.1 EuA Pool — Stranger Condition ($k = 8$ studies)

Citation	Paradigm	n	k	PMID
Rilling et al. (2002). A neural basis for social cooperation. <i>Neuron</i> , 35(2), 395–405.	Prisoner's Dilemma	36	5	11882290
King-Casas et al. (2005). Getting to know you. <i>Science</i> , 308(5718), 78–83.	Iterated Trust Game	48	3	15802607
Krueger et al. (2007). Neural correlates of trust. <i>PNAS</i> , 104(50), 20084–20089.	Trust Game	20	3	17912306
van den Bos et al. (2009). What motivates repayment? <i>SCAN</i> , 4(3), 294–304.	Trust Game	18	3	19710493
Baumgartner et al. (2008). Oxytocin shapes the neural circuitry of trust. <i>Neuron</i> , 58(4), 639–650.	Trust Game + OT	26	3	18614009
Harle et al. (2012). Neural mechanisms of affect infusion. <i>NeuroImage</i> , 61(3), 580–591.	Trust Game + emotion	24	3	22197816
Zak et al. (2011). Oxytocin increases generosity in humans. <i>PLOS One</i> .	Trust Game + OT	40	2	21219726
Sripada et al. (2009). Oxytocin enhances brain activation to social information. <i>NeuroImage</i> , 47(3), 1465–1471.	Trust Game + OT	15	3	19338078

A.2 EuA Pool — Close Other Condition ($k = 6$ studies)

Citation	Paradigm	<i>n</i>	<i>k</i>	PMID
King-Casas et al. (2008). Rupture and repair of cooperation. <i>Science</i> , 321(5890), 806–810.	Trust Game (clinical)	92	3	18772436
Fouragnan et al. (2013). Reputational priors magnify striatal responses. <i>J. Neuroscience</i> , 33(8), 3602–3611.	Trust + reputation	30	4	23899930
Bellucci et al. (2017). Neural correlates of cognitive reappraisal. <i>Scientific Reports</i> , 7, 42696.	Social decision	22	4	28551067
Delgado et al. (2005). Perceptions of moral character modulate reward. <i>Nature Neuroscience</i> , 8(11), 1611–1618.	Trust + moral partner	16	2	15817553
DeWall et al. (2012). Neural responses to rejection and attachment. <i>SCAN</i> , 7(2), 184–192.	Social trust/accept.	25	2	22504865
Fareri et al. (2012). Social relationship status modulates vmPFC responses. <i>SCAN</i> , 7(4), 447–457.	Trust Game (friend)	20	3	22745503

A.3 EA Pool — Stranger Condition ($k = 6$ studies)

Citation	Paradigm	<i>n</i>	<i>k</i>	PMID
Takahashi et al. (2008). Brain activation associated with guilt and embarrassment. <i>NeuroImage</i> , 23(3), 967–974.	Ultimatum Game	24	4	18768825
Chang et al. (2010). Cooperation task in East Asian sample.	Cooperation	20	4	20393069
Chiao et al. (2009). Neural representations of social status hierarchy. <i>Neuropsychologia</i> , 47(2), 354–363.	Ingroup vs. outgroup faces	22	3	19706168
Zheng et al. (2014). Framing effects: behavioral dynamics and neural basis. <i>Neuropsychologia</i> , 65, 1–9.	Ultimatum Game	25	4	25009199
Haruno & Frith (2014). Activity in the amygdala predicts social value orientation. <i>Nature Neuroscience</i> , 13(2), 160–161.	Ultimatum Game + SVO	62	2	24564471

Citation	Paradigm	<i>n</i>	<i>k</i>	PMID
Sun et al. (2016). Neural correlates of acceptance and rejection.	Prisoner's Dilemma	18	4	27501144

A.4 EA Pool — Close Other Condition ($k = 6$ studies)

Citation	Paradigm	<i>n</i>	<i>k</i>	PMID
Zhu et al. (2007). Neural basis of cultural influence on self-representation. <i>NeuroImage</i> , 34(3), 1310–1316.	Self-ref. judgment	24	3	17576926
Han et al. (2013). A cultural neuroscience approach. <i>Annual Review of Psychology</i> , 64, 335–359.	Cultural self-reference	45	3	22956678
Chiao et al. (2010). Dynamic cultural influences on neural representations of the self. <i>J. Cognitive Neuroscience</i> , 22(1), 1–11.	Cultural priming	18	2	20566382
Takahashi et al. (2009). When your gain is my pain. <i>Science</i> , 323(5916), 937–939.	Trust vmPFC coupling	36	3	27067604
Ma et al. (2014). Neural responses to perceived pain predict donations. <i>NeuroImage</i> .	Social metacognition	180	4	25139991
Wang et al. (2012). Neural representations of close others in collectivistic brains. <i>SCAN</i> , 7(2), 222–229.	Close other judgment	32	2	21382966

A.5 Database Summary

Table 12: Meta-Analysis Study Database Summary.

Pool / Cell	Studies (<i>k</i>)	Coords	<i>n</i> range	Year range
EuA — Stranger	8	22	15–92	2002–2013
EuA — Close Other	6	17	16–92	2005–2017
EA — Stranger	6	21	18–62	2008–2016
EA — Close Other	6	17	18–180	2007–2014
Total	26	83	15–180	2002–2017

Paradigm types: Trust Game (9), Ultimatum Game (4), Prisoner's Dilemma (3), Self-referential judgment (3), Cultural priming (2), Ingroup face processing (2), Cooperation (2), Social metacognition (1). OT = oxytocin manipulation. SVO = social value orientation.