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Exploring the Interplay between Interoceptive Awareness and Social Cognition. A Network Analysis Study

Juan Pablo Morales
University of Sydney Business School
Felipe Rojas-Thomas
Universidad Adolfo Ibáñez
Mesepa Paul
University of Sydney Business School
Macarena Moreno
Universidad de Chile
Daniela Huepe
Universidad Adolfo Ibáñez
Daniel Andres Franco OByrne
Universidad Adolfo Ibáñez
Roberto García
Universidad Diego Portales
Joaquin Migeot
Universidad Adolfo Ibañez, Metropolitan Region of Santiago
Paola Solano
Universidad Adolfo Ibáñez
David Huepe
david.huepe@uai.cl

Universidad Adolfo Ibáñez

Article

Keywords: Interoceptive awareness, Empathy, Theory of Mind, Facial Emotion Recognition, Network Analysis.

Posted Date: August 3rd, 2026

DOI: https://doi.org/10.21203/rs.3.rs-8274314/v1

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Additional Declarations: No competing interests reported.

Abstract

Interoception is increasingly recognised as a key contributor to socio-emotional functioning, yet its multidimensional links to distinct components of social cognition remain unclear. This study investigated how multiple dimensions of interoceptive awareness (IA) relate to empathy, Theory of Mind (ToM), and facial emotion recognition (FER) in 214 healthy adults, after excluding individuals with psychiatric, neurological, or substance-use conditions. Using a multidimensional network analysis approach, we modelled interdependencies among IA subscales and socio-cognitive measures to capture domain-specific patterns rather than isolated associations. The resulting network revealed strong connections between regulatory and interpretive IA dimensions, particularly Emotional Awareness, Self-Regulation, and Attention Regulation, and cognitive components of empathy. In contrast, IA showed only weak, indirect associations with ToM and FER. Noticing demonstrated high closeness and betweenness, suggesting a potential bridging role despite lower absolute edge weights. These findings highlight interoception as a multidimensional system with differential contributions to social cognition.

Introduction

Social cognition (SC) relies on the ability to interpret external cues, such as facial expressions and gaze, as well as internal bodily signals that shape the subjective experience of emotion. While the role of perceptual and cognitive mechanisms in social cognition is well established, the contribution of internal body awareness (IA), the perception, interpretation, and regulation of internal physiological signals (Craig, 2014; Tsakiris & Critchley, 2016), is increasingly recognised as a core component of self-awareness and socio-emotional functioning.

Empathy offers a particularly relevant case. Defined as the capacity to share and understand the feelings of others, empathy comprises affective resonance and cognitive perspective-taking (Decety & Holvoet, 2021; Singer & Lamm, 2009). Several studies indicate that individuals with heightened interoceptive sensitivity respond more accurately and appropriately to others' emotions (Grynberg & Pollatos, 2015; Mul et al., 2018), suggesting that mapping one's internal states provides a scaffold for representing the emotions of others (Ondobaka et al., 2017; Stoica & Depue, 2020). While some conceptual accounts link interoception to ToM and Facial emotion recognition (Fotopoulou & Tsakiris, 2017; Shah et al., 2017), empirical evidence in these domains remains scarce and mixed (Ainley; Otten et al., 2017). In contrast, the association between IA and empathy has been replicated across multiple studies, suggesting that interoceptive processes may be more directly implicated in affective sharing and emotional resonance than higher-order inferential or perceptual tasks. This highlights a gap: although IA has been conceptually tied to a range of socio-cognitive abilities, only empathy shows consistent empirical support, leaving unclear whether IA exerts domain-general effects or whether its influence is stronger for embodied processes such as empathy.

The role of IA has also been discussed in relation to Theory of Mind (ToM), the ability to infer beliefs, intentions, and emotions of others (Frith & Frith, 2006). Theoretical accounts if interoceptive inference

propose that accurate prediction of bodily signals may facilitate mental state attribution (Fotopoulou & Tsakiris, 2017; Shah et al., 2017). Yet, evidence to date is largely conceptual, with little empirical work testing these links directly. A similar situation applies to facial emotion recognition (FER). While several studies suggest that individuals with stronger interoceptive skills perform better in identifying basic emotional expressions (Butera et al., 2023; Dirupo et al., 2020), findings remain mixed, and the specific contribution of distinct IA dimensions is not well characterised. Thus, a second gap concerns the comparative role of IA across different facets of SC: existing research does not clarify whether IA contributes similarly to empathy, ToM, and FER, or whether its influence is more selective.

Among the MAIA domains, emotional awareness, attention regulation, and self-regulation are especially relevant for empathic functioning. Emotional awareness facilitates mapping internal states onto perceived emotions of others (Ondobaka et al., 2017). Attention regulation has been linked to effective emotion regulation strategies and sustained empathic engagement (Gross, 2015; Mehling et al., 2012). Self-regulation, in turn, allows adaptive modulation of arousal in the presence of others' distress, a process central to compassion and empathic concern (Decety & Jackson, 2004). Despite these links, no study has examined whether these domains operate as central hubs within a broader IA-SC system. This represents a third gap: while theory suggests that certain regulatory interoceptive processes are particularly important for empathy, this has not been tested using methods capable of identifying their relative centrality within a network.

The MAIA 'noticing' scale, reflecting basic interoceptive detection of bodily sensations, may also serve as a bridge between embodied experience and higher-order perspective-taking. Detecting subtle bodily states has been argued to ground the self-other distinction (Tsakiris, 2017) and may scaffold imaginative processes such as Fantasy, which rely on simulating another's affective perspective (Preston & Hofelich, 2012). Yet, this potential bridging function has not been investigated empirically, leaving a four-gaps: the field lacks evidence on whether low-level interoceptive detection provides a foundation for more complex socio-cognitive operations such as ToM and Fantasy.

Together, the existing work points interoceptive as a candidate mechanism underlying multiple aspects of SC, but no study has yet examined how different dimensions of IA simultaneously relate to empathy, ToM, and FER, nor how these interconnections form a broader system. Prior research has typically focused on bivariate associations between IA and their joint contributions to social cognition. This creates a final gap: the need for approaches that capture the complex, multivariate nature of the IA-SC relationship rather than treating them as isolated pairwise effects. Given that interoceptive dimensions are interrelated and likely exert overlapping influences on multiple facets of social cognition, a network approach provides a theoretically appropriate lens to address this limitation (Borsboom et al., 2021). This provides a novel means to assess how interoceptive processes map onto social cognition.

The present study investigated the multidimensional relationship between IA and three facets of social cognition: empathy, ToM, and FER. Interoceptive processes were assessed using the Multidimensional Assessment of Interoceptive Awareness (MAIA; Mehling et al., 2012), which captures several domains

explained in more detail in the methods section. SC was measured using established instruments for empathy (IRI), ToM (RMET), and FER (mini-SEA).

Our research question was: which dimensions of interoceptive awareness are most strongly associated with empathy, ToM, and FER, and how do these interconnections shape the overall social cognition network? We hypothesised that: a) IA would show stronger associations with empathy than ToM or FER, reflecting its embodied bases. b) emotional awareness, attention regulation, and self-regulation would emerge as central nodes within the network, given their relevance for empathic processes. c) noticing would function as a bridge between IA and higher-order socio-cognitive processes, such as ToM and Fantasy, reflecting the role of bodily self-representations in perspective-taking.

To our knowledge, this is the first study to examine these relationships using a multidimensional, network-based approach. Our findings provide novel insights into how interoceptive awareness scaffolds empathy and, more broadly, social cognition.

Methods

Participants

214 adults (113 female and 101 male) participated in this study. Ages ranged between 18 to 46 (female: M=31.5, SD=7.88; male: M=30.44, SD=7.82). Educational level is represented by categories (female: M=4.38, SD=0.87, and male: M=4.48, SD=0.84). Participation was voluntary, and data were anonymised. People with psychiatric, neurological, or a diagnosis of substance abuse conditions were excluded from the study. The study received prior approval from the ethics committee of Adolfo Ibañez University and followed the protocol of the Declaration of Helsinki. Finally, all participants provided a signature as proof of their informed consent.

Procedure

Trained psychologists administered all the protocols and evaluations. The evaluators ensured each participant read and understood the informed consent before the protocol administration. Participants were told to stop the protocol at any time if they needed to or ask questions regarding the evaluation to the examiner. The instruments were randomly displayed to each participant to avoid possible bias. Participants took around 25-30 minutes to complete this protocol.

Instruments

This protocol includes measures for interoceptive awareness, which are evaluated through the multidimensional assessment of interoceptive awareness (MAIA). Empathy is measured with the Interpersonal Reactivity Index (IRI); the theory of mind was evaluated in the Reading the Mind in the Eyes Test (RMET), and emotion recognition via the Eckman Facial Emotion Recognition (FER). Reliability from instruments was calculated with the split-half methods (Spearman-Brown coefficient) for dichotomic scales and Cronbach's α from Likert instruments. Descriptive and reliability instruments are summarised

in Table 1. IRI shows lower reliability in the Empathic Concern (EC) dimension, Table S1, and because of that, we performed an Exploratory Factor Analysis on the IRI instrument (IRI-EFA), Table S2.

MAIA: The Multidimensional Assessment of Interoceptive Awareness evaluates multiple facets of IA. It is a 32-item scale scored between 0 (never) to 5 (always). We included six dimensions: *Noticing* is the evaluation of the awareness of uncomfortable, comfortable, or neutral body sensations. *Attention Regulation* evaluates the ability to sustain and control attention to body sensations. *Emotional awareness* assesses the ability to attribute specific physical sensations to physiological manifestations of emotions. *Self-regulation* evaluates the ability to regulate distress by paying attention to body sensations. *Body listening* assesses the tendency to actively listen to the body for insight. *Trusting* evaluates the experience of one's body as safe and trustworthy (Mehling et al., 2012). Not Distracting and Not Worrying were not included in the network analysis because of their reliability level.

IRI:The Interpersonal Reactivity Index was developed to assess four dimensions of empathy (Empathic Concern, Perspective-Taking, Personal Distress, and Fantasy). Each subscale contains seven items, scoring between 0 and 4. The Empathic Concern subscale assesses emotional empathy or feelings of compassion for others in distress. The Perspective Taking subscale considers cognitive empathy, or the tendency to see the world from others' viewpoints. The Personal Distress subscale assesses self-focused responses to others' suffering. The Fantasy subscale assesses empathy for fictional characters. The first three subscales have exhibited relationships to more adaptive interpersonal (e.g., prosocial behaviour) and intrapersonal (e.g., mental well-being) functioning (Davis, 1983a; Fernández et al., 2011).

RMET: The reading the mind in the eyes test was developed to evaluate the theory of mind by presenting 17 images of gazes (not the entire face). The emotional state must be inferred from the image in a pool of 4 emotions scored as correct or incorrect (Baron-Cohen et al., 2015).

FER:Facial emotion recognition test, from Ekman pictures, evaluates the ability to categorise emotions depicted on a screen. This test is scored 0 to 15 and includes emotional expressions from images of females and males (Ekman et al., 2002).

Data analysis

Descriptive, correlational analysis and plotting were conducted using Python (v. 30.10); Pandas, NumPy, Matplotlib, and Seaborn were the main libraries. For network analysis, the qgraph R package was used in V. 4.3.0.

Demographics and Descriptives:

For demographics, we considered the counts for gender (male, female); for age and education (assessed as categories described in results), we calculated the mean and standard deviation (SD). The descriptive analysis considers mean, SD, and reliability for all the instruments and dimensions used in this work.

Correlation:

To understand the association between the variables utilised in this project, we computed a Pearson correlation analysis, as represented in Figure 1.

Network estimation

A network graph comprises nodes (the variables used for the network) and edges (the relationships between the nodes). Edge weight refers to the strength of the relationship between two nodes. These associations are not explicitly present in a data set but can be estimated by calculating partial correlations between variables, controlling for all other variable connections (Epskamp S, Borsboom D, Fried EI, 2018).

We estimate a Gaussian Graphical Model (GGM) to estimate regularised partial correlation networks with the GLASSO method (Tibshirani, 1996) that reduces small partial correlations to 0, resulting in a sparse network and showing only the most important relationships. To see the unregularised network, please visit Figure S1.

EBICglasso was used to find the best network model fit. This method selects the optimal degree of contraction according to an Extended Bayesian Information Criterion (EBIC) and hyperparameter set at 0.5 (Foygel & Drton, 2010). This procedure requires estimating the variance-covariance matrix and returns a parsimonious network of partial correlation coefficients. Given that some variables are ordinal, we computed a polychoric correlation matrix as input. We can do this using the cor_auto function from the qgraph package, which automatically detects ordinal variables. The EBICglasso function of the qgraph package can then be used to estimate the network structure using the glasso package (Friedman et al., 2014).

Node centrality

A node with high centrality is a node that is particularly structurally important in the network based on the strength of its connections to other nodes. A node's centrality can be used to infer its influence or structural importance in the network. Strength (or degree), betweenness, closeness, and expected influence (Robinaugh, R., et al., 2016) are commonly reported centrality indices (Opsahl T, Agneessens F, Skvoretz J., 2010).

Given that the networks were estimated from partial correlations and the phenomenon does not seem to correspond to a flow process, in addition to the indices of closeness and betweenness, we included strength and expected influence as measures of centrality (Bringmann, L., et al, 2019). This allows us to have a comprehensive view of centrality measures.

Strength is defined as the sum of the absolute value of all edge weights of a node (Opsahl T, Agneessens F, Skvoretz J, 2010). Expected influence is similar to strength, but it considers if an edge weight is negative or positive by removing the usage of absolute values of edge weights when computing a node’s strength in favour of actual values (Robinaugh et al. RJ., 2016). Therefore, nodes with high expected influence are more central in the network.

Network accuracy and stability

The network stability analysis follows the routines proposed by Epskamp, Borsboom and Fried (2018): Firstly, we estimate the edge weights' precision by developing a bootstrap CI. Next, we investigated the stability of the centrality indices after observing only a subset of the data (Figure S2).

Edge-weight accuracy

The accuracy of edge weights can be assessed using bootstrapped non-parametric 95% confidence intervals (CIs) (Epskamp S, Borsboom D, Fried EI., 2018); Narrower CIs suggest more precise estimation of the edge and therefore more accuracy. We tested the accuracy of each network using nonparametric bootstrapping. This process repeatedly resamples subsets of the data to calculate a confidence interval (CI) as the range of bootstrap values from different sampling levels. To evaluate the accuracy of the edge weights, we used 19,000 iterations of model estimation with sampled data and calculated 95% confidence intervals (CIs). A large CI indicates that the edge weight may be difficult to interpret, while a small CI can be interpreted as an accurate estimate (Figure S3).

Centrality stability

The stability of centrality indices can be examined using case-dropping bootstrap analysis. This method examines whether the order of centrality indices remains the same after re-estimating the network with fewer cases quantified in terms of the correlation stability coefficient (CS-coefficient), Figure S4.

The CS-coefficient reflects the correlation between the original centrality indices (based on the complete data) and the correlation obtained from the subset of data representing different percentages of the overall sample. If the CS coefficient remains stable after removing a considerable proportion of the cases (e.g., 10%), then the interpretations of the centralities can be considered stable. Although a CS coefficient of 0.7 or higher has been suggested as a threshold, it is suggested that the CS coefficient should be at least 0.5. (Epskamp S, Borsboom D, Fried EI, 2018).

Expected replicability

The generalizability of network structures can be evaluated by comparing results in different samples. This is typically assessed by examining the similarity of network structures between samples. (Borsboom, D., Deserno, M. K., Rhemtulla, M., Epskamp, S., Fried, E. I., McNally, R. J., & Waldorp, L. J. (2021) (Figure S5).

To investigate the expected replicability of the network structure estimate between samples (Epskamp, S., 2020), a set of replication data was simulated and generated from the estimated network model using the netSimulator function of the bootnet package. In this way, we evaluate the expected network replicability that one should expect if the estimated networks were the true networks for different sample sizes.

The performance of the simulation study was evaluated based on sensitivity and specificity metrics (van Borkulo et al., 2014), as well as the expected correlation between the edge weights for two replication data sets generated from the true network. These measures investigate the estimated (or detected) edges versus the edges in the true model.

Sensitivity, also called true positive rate, provides the ratio of the number of true edges detected in the estimation versus the total number of edges in the true model. Specificity, also called true negative rate, provides the ratio of missing true edges detected in the estimation versus the total number of missing edges in the true model.

Results

Table 1. Descriptive of psychological characteristics

Interoceptive Awareness (MAIA)					Reliability
Dimensions	**mean**	**SD**	**min**	**max**	**Cronbach's α**
Nt	13.47	4.70	0	20	0.68
ND	7.40	3.61	0	15	0.48
NW	7.60	2.90	0	15	0.06
AR	21.64	8.15	0	35	0.87
EA	18.49	5.78	0	25	0.84
SR	12.43	4.98	0	20	0.82
BL	8.08	4.19	0	15	0.80
Tr	10.41	3.62	0	15	0.80
IA	84.53	25.59	0	130	0.94
Empathy (IRI)					
	mean	**SD**	**min**	**max**	**Cronbach's α**
Ft	6.71	4.32	0	16	0.77
CE	19.82	4.76	8	28	0.68
PD	4.92	3.38	0	13	0.61
IRI	31.46	8.64	12	56	0.73
Theory of mind (RMET)					
	mean	**SD**	**min**	**max**	**Spearman-Brown**
ToM	11.63	2.84	5	19	0.95
Facial Emotion Recognition (Eckman)					
	mean	**SD**	**min**	**max**	**Spearman-Brown**
FER	28.52	3.18	16	35	0.99

Table 1. Nt = Noticing; **ND** = Not Distracting; **NW** = Not Worrying; **AR** = Attention regulation; **EA** = Emotional Awareness; **SR** = Self-regulation; **BL** = Body Listening; **Tr** = Trusting; **IA** = Interoceptive Awareness. Note that IA does not consider the scores from ND and NW because of low reliability. **Ft** = Fantasy; **CE** = Cognitive empathy; **PD** = Personal Distress; **IRI** = Interpersonal Reactivity Index (Exploratory Factor Analysis). Given the initial low reliability of IRI, we decided to perform an exploratory factor analysis, resulting in three factors. **ToM = Theory** of Mind from the Reading the Mind in the Eyes Test. **FER = Facial** Emotion Recognition. Importantly, ND and NW were not included in the posterior analysis.

Correlation between interoceptive awareness and social cognition dimensions

There was a significant relationship between the interoceptive awareness (total IA score) and the empathic measures; most dimensions from interoceptive awareness correlate positively and significantly with empathic dimensions (Figure 1): total IRI score, r =.25, p<.001; CE, r =.29, p<.001 and Ft, r =.19, p<.01. Theory of mind correlated with Noticing (Nt), r =.14, p<.05. Facial Emotion Recognition does not correlate with any interoceptive measure, neither total score nor dimensions. However, it was positively correlated with empathy r =.18, p<.01, and theory of mind r =.37, p<.001.

The regularised partial correlation between interoceptive awareness and social cognition dimensions

A partial correlation calculation was performed between parameters and their sub-dimensions to assess the type and strength of association between the dimensions composing AI and social cognition (Figure 2). This was visually represented by each circle, which represents a node (variables observed and evaluated in each of the scales); the edges, which represent the association between nodes; the blue and red colours, which represent the positive and negative association, respectively; and the thickness of the edges, which represents the strength of association. A positive association can be observed between the nodes BL and AR, SR and TR, EA and AR, and AR and Nt in the nodes that make up the AI.

Identification of structurally essential nodes in the AI and social cognition network

To identify central nodes, we measured whether the associations in a given network are concentrated in a single node or a group of nodes. The present study used four measures: Closeness, Betweenness, Strength, and Expected Influence. Closeness: quantifies the distance between the node and all other nodes by averaging the lengths of the shortest paths to all other nodes. The primary nodes in this measure are AR and Nt. Betweenness: This measure quantifies the frequency with which a node is on the shortest path connecting two other nodes. The primary dimensions are AR, Nt, and Ft. Strength: the sum of the absolute weights of the edges per node. The nodes that present a higher strength are AR and SR. Expected influence: This calculation considers the sign of the weights of the edges; it can be observed that the dimensions AR and SR present a higher value in this measure (Figure 3). In our analysis, we employed both unregularised and regularised centrality measures to assess node importance within the network. This dual approach allowed us to capture baseline structural properties while enhancing robustness to noise and sparsity through regularisation.

Discussion

The present study examined how multiple dimensions of interoceptive awareness (IA) relate to three pillars of social cognition: empathy, ToM and FER within a multidimensional network framework. The network revealed a differential profile: IA showed its strongest and most coherent links with empathy, whereas associations with ToM and FER were comparatively modest. Importantly, different IA facets occupied distinct structural roles, with regulatory and interpretive IA dimensions emerging as core hubs, while the perceptual facet, Noticing, functioned as a bridge, displaying high closeness and betweenness

despite low direct strength. These findings refine current models proposing that interoception forms a foundational substrate for socio-emotional functioning (Craig, 2009; Tsakiris & Critchley, 2016; Quadt et al., 2018).

The strongest interoception – empathy links involved regulatory and interpretive IA dimensions, Attention Regulation, Emotional Awareness, and Self-Regulation, which showed high centrality. These results converge with social neuroscience theories emphasising that empathy depends on the integration of internal bodily signals, with affective processing systems (Decety & Jackson, 2004; Singer & Lamm, 2009; De Waal, 2008). Empirical work similarly shows that interoceptive sensibility predicts enhanced empathic understanding and affective resonance (Grynberg & Pollatos, 2015; Mul et al., 2018; Hübner et al., 2021), and that interoceptive awareness modulates neural responses during the perception of emotional states (Ernst et al., 2013; Balconi & Angioletti, 2021). Moreover, the involvement of regulatory IA dimensions aligns with evidence that emotion regulation processes are tightly linked to empathy and broader socio-affective functioning (Füstös et al., 2013; Thompson et al., 2022; Salazar Kämpf et al., 2023). These findings show that empathy is not merely grounded in perceptual interoceptive sensitivity but relies especially on the ability to interpret and modulate internal states. This supports models in which interoception contributes to socio-emotional competencies through bot perceptual and regulatory pathways (Adolphs et al., 2018; Price & Hooven, 2018).

By contrast, associations between IA and ToM were modest and fragmented. Although theoretical models propose that interoceptive inference may scaffold mentalising by supporting predictions about others' internal states (Seth, 2013; Fotopoulou & Tsakiris, 2017; Ondobaka et al., 2017), the empirical literature remains limited. Our findings align with evidence suggesting that ToM, particularly as measured by RMET, depends more strongly on perceptual-cognitive mechanisms involving the temporo-parietal junction and related social brain regions (Frith & Frith, 2006; Saxe & Kanwisher, 2003). The limited IA-ToM associations observed here echo recent findings showing only selective interoceptive contributions to mental state inference (Canino et al., 2022; Raimo et al., 2021).

Similarly, FER showed only weak links with IA. This aligns with prior work indicating that FER performance is predominantly driven by visual-perceptual processing and broader socio-affective competencies (Haxby et al., 2000; Qi et al., 2022). Although some studies suggest IA may support subtle affective appraisal (Dirupo et al., 2020; Butera et al., 2023), our results indicate that interoception plays a relatively limited role in explicit facial emotion recognition.

Noticing, the most basic perceptual IA dimension, displayed low strength but high closeness and betweenness, suggesting that it serves as an integrative bridge rather than a direct driver of socio-cognitive outcomes. This structural position indicates that foundational interoceptive detection contributes indirectly to socio-emotional functioning by facilitating connectivity between regulatory IA processes and socio-cognitive traits such as Fantasy or ToM. This interpretation aligns with theoretical accounts proposing that basic interoceptive detection supports self-other distinction and embodied

simulation (Gallese, 2007; Palmer & Tsakiris, 2018), and with emerging network-based evidence showing that Noticing often functions as a connector within broader socio-affective systems (Yang et al., 2022).

A major strength of this study is the application of psychological network analysis, which enables the examination of multiple IA facets simultaneously and highlights their heterogeneous contributions. Network models help clarify how distinct interoceptive components interact to support socio-cognitive functions, offering insights beyond those afforded by bivariate or latent-variable approaches (Borsboom et al., 2021; Epskamp et al., 2018). Our results underscore that IA is not a unitary construct but a multidimensional system in which regulatory and interpretive processes, rather than perceptual ones, play primary roles in supporting empathy.

Several limitations should be acknowledged. First, the cross-sectional design limits causal inference; experimental manipulation of interoception through contemplative or body-based training may clarify directionality (Farb et al., 2015; Price & Hooven, 2018). Second, ToM was assessed with an emotion-inference task; incorporating belief-based tasks may reveal different associations, as evidence suggests ToM is heterogeneous and partly independent from affective processing (Henry et al., 2013; Happe et al., 2017). Third, the sample of healthy adults limits generalisability. Interoception and social cognition show significant disruptions in clinical groups such as autism (Brewer et al., 2016; Butera et al., 2023), anxiety (Paulus et al., 2019), eating disorders (Brown et al., 2017; Margarita et al., 2020), and depersonalization (Sedeño et al., 2014), making these populations promising contexts for extending this network approach.

Finally, future research should examine interoceptive accuracy and confidence, which represent distinct dimensions of interoception (Garfinkel et al., 2013; Ferentzi et al., 2018) and may show different patterns of associations with social cognition.

Conclusion

This study shows that interoceptive awareness is most strongly connected to empathy, particularly through IA facets reflecting emotional interpretation and regulatory control. While ToM and FER exhibited modest relationships with interoception, the perceptual dimension Noticing played a bridging role, underscoring its contribution to global network integration rather than direct socio-cognitive effects. By leveraging a network analytic framework, we highlight the multidimensional architecture of interoceptive processes and their differentiated roles in supporting social cognition.

Declarations

Funding

This work was supported by grants from Comisión Nacional de Investigación Científica y Tecnológica (ANID/FONDECYT Regular N° 1231117 to David Huepe).

Conflict of interest.

Following the COPE guidance, the authors declare no conflict of interest in this manuscript.

CREDIT

Juan-Pablo Morales: Conceptualisation, Methodology, Formal analysis, Investigation, Data curation, Writing - Original Draft. **Macarena Moreno:** Conceptualisation, Writing - Original Draft. **Daniel Franco-O'Byrne:** Writing - Review & Editing. **Mesepa Paul:** Conceptualisation, Writing - Original Draft. **Felipe Rojas:** Conceptualisation, Writing - Original Draft. **Roberto García:** Software, Writing - Review & Editing. **Daniela Huepe:** Conceptualisation, Investigation, Writing - Review & Editing. **Joaquin Migueot:** Writing - Review & Editing. **Paola Solano:** Writing - Review & Editing. **David Huepe:** Conceptualisation, Resources, Writing - Review & Editing, Supervision, Funding acquisition.

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Figures

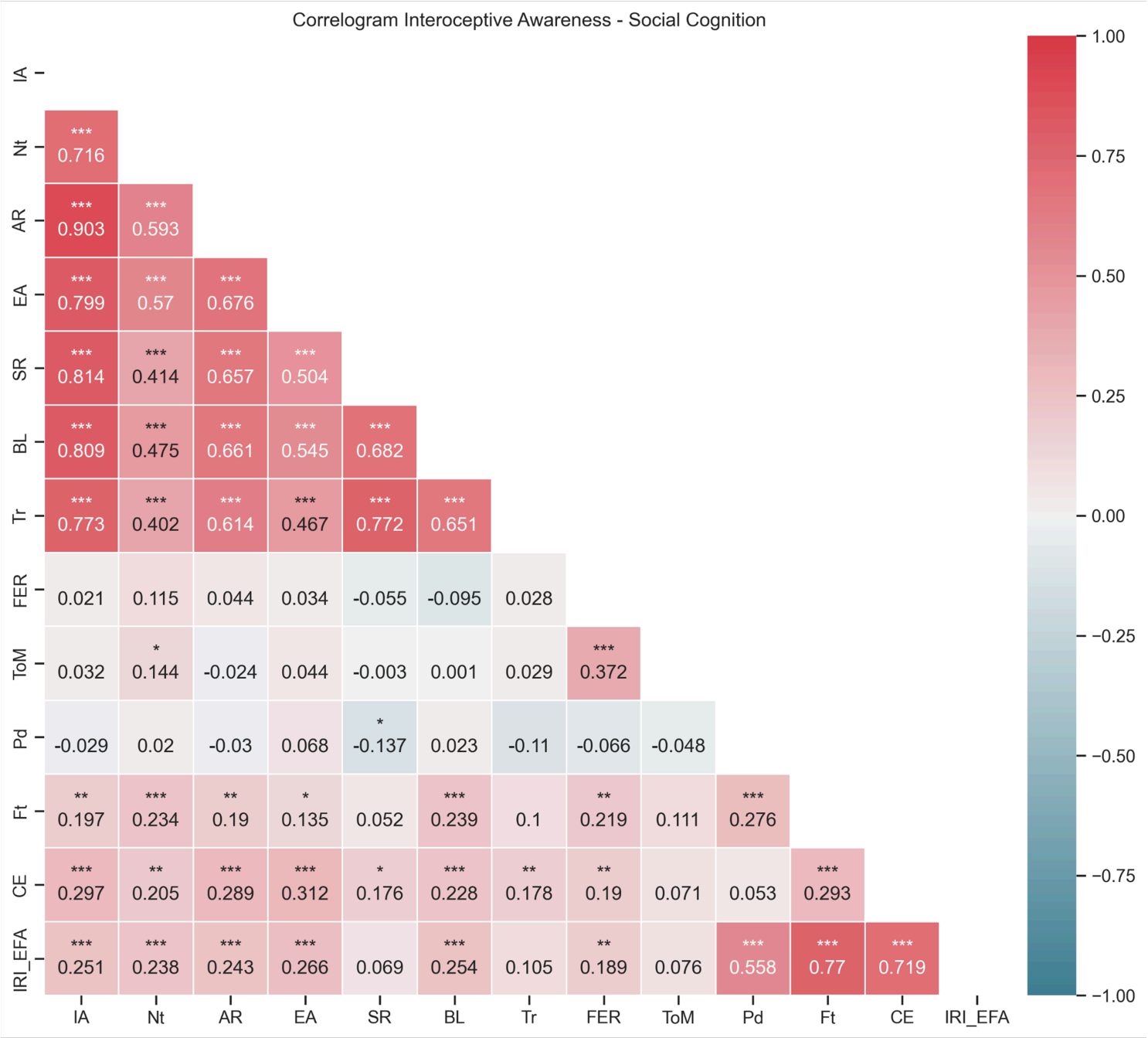


Figure 1

Represents the correlation between different dimensions of interoceptive awareness and social cognition.

Each cell contains the Pearson Correlation value and its significance in the asterisk. The right bar indicates if the correlation is positive (Red) or negative (blue). **IA** = Interoceptive Awareness; **Nt** = Noticing; **AR** = Attention regulation; **EA** = Emotional Awareness; **SR** = Self-regulation; **BL** = Body Listening; **Tr** = Trusting; **FER = Facial** Emotion Recognition; **ToM = Theory** of Mind; **PD** = Personal Distress; **Ft** = Fantasy; **CE** = Cognitive empathy; **IRI (EFA)** = Interpersonal Reactivity Index. P≤0.05*; P≤0.01**; P≤0.001***.

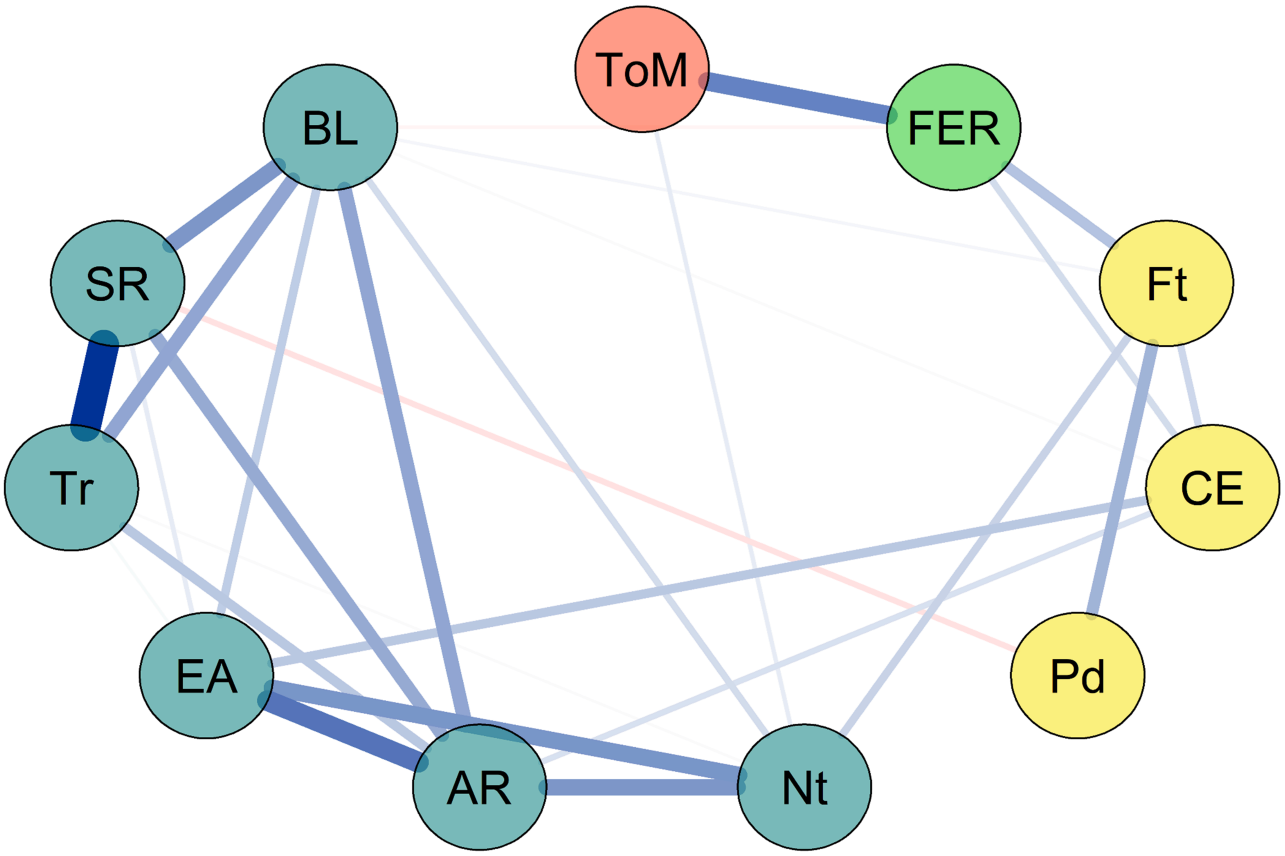


Figure 2

Regularised Partial Correlation and centrality measures.

Depicts the regularised partial correlation between interoceptive awareness and social cognition dimensions. Each circle represents a node, the set of observed variables evaluated in scales; edges represent the association between nodes; blue and red represent the positive and negative association, respectively; the thickness of the edges represents the association strength. **Nt**= Noticing; **AR**= Attention regulation; **EA**=Emotional Awareness; **SR**=Self-regulation; **BL**=Body Listening; **Tr**=Trusting; **FER**=Facial Emotion-Recognition; **ToM**=Theory of Mind; **PD**=Personal Distress; **Ft**= Fantasy; **CE**=Cognitive empathy.

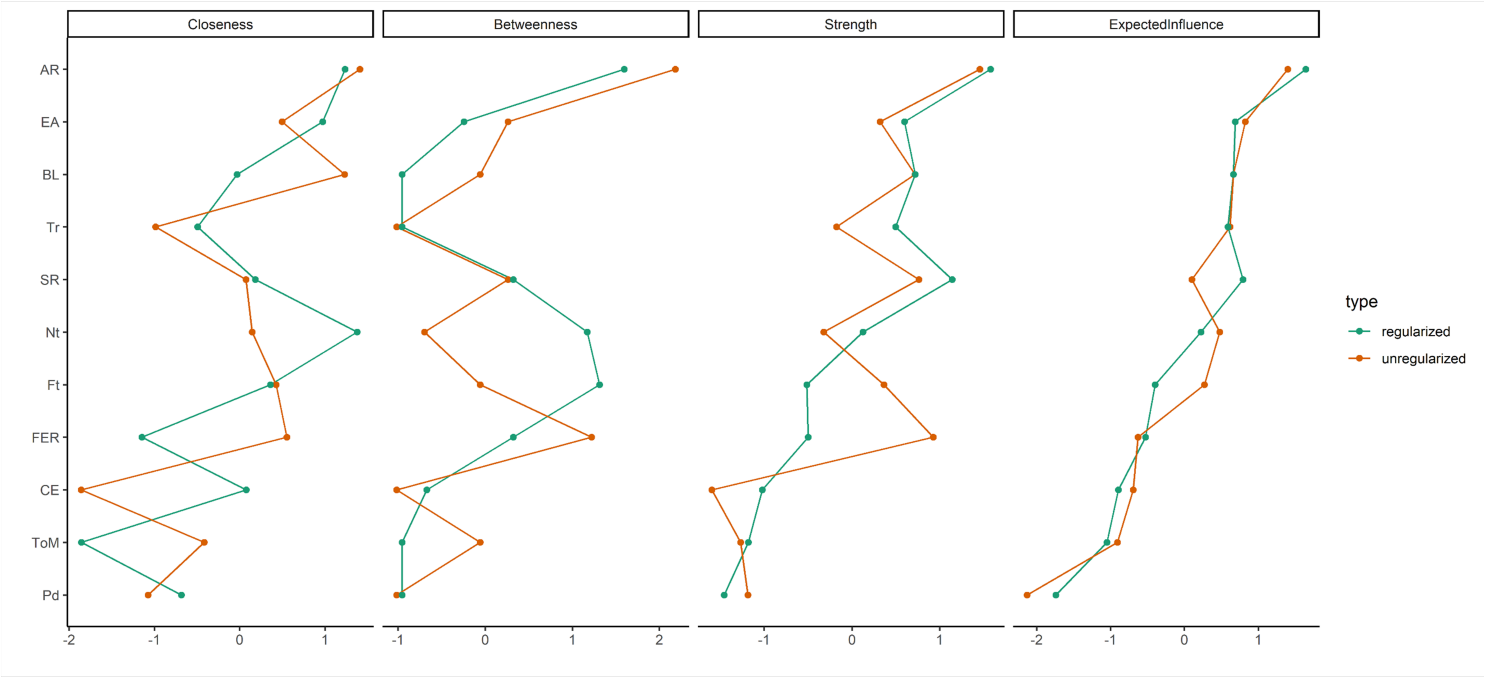


Figure 3

Centrality Measures

The vertical axis lists the network nodes, while the horizontal axis represents standardised centrality scores (z-scores), allowing comparison of node importance across the four centrality measures. **Closeness**: quantifies the distance between the node and all other nodes by averaging the shortest path lengths to all other nodes; **Betweenness**: quantifies how often a node lies on the shortest path connecting any two other nodes; **Strength**: sums the absolute edge weights per node; **Expected Influence**: takes the sign of edge weights into account. **Regularised**: Each node is used as the dependent variable in a penalised regression function to identify which other nodes are connected to the relevant node. And **Unregularized**: Do not use a penalised likelihood function in network structure estimation. **Nt**= Noticing; **AR**= Attention regulation; **EA**=Emotional Awareness; **SR**=Self-regulation; **BL**=Body Listening; **Tr**=Trusting; **FER**=Facial Emotion-Recognition; **ToM**=Theory of Mind; **PD**=Personal Distress; **Ft**= Fantasy; **CE**=Cognitive empathy.

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