

Opinion

The Emerging Social Neuroscience of Justice Motivation

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Humans from a very early age are deeply sensitive to issues of justice and fairness, both in their own lives and in the lives of others. Most people are highly motivated to pursue justice and condemn injustice. Where does this concern for justice come from? Here we integrate findings in evolution, development, psychology, behavioral economics, and social neuroscience to highlight multiple potential drivers of justice motivation. We argue that justice motivation arises from complementary rapid heuristics and deliberation, each utilizing distinct and interacting neural circuitry. This framework is useful for explaining observed symmetries and asymmetries in responses to experiencing or observing injustice and may help to explain why individuals vary in their responses to injustice.

The Path to the Neuroscience of Justice Motivation

Justice (see [Glossary](#)) is a fundamental concern of human societies and a critical component of **morality** [1,2]. Research examining people's reactions to injustice directed at themselves or third parties reveals that individuals are motivated by considerations of justice such as **fairness**, **equality**, and **equity** [3]. Although people generally prefer justice and seek to avoid injustice, individuals differ in both their propensity to perceive injustice in a particular situation and the extent to which they are motivated to respond to instances of injustice [4]. Understanding these differences is a central issue in numerous domains including law and politics, economics, psychology, medical ethics, and business. This Opinion article develops a social neuroscience perspective that relies on the integration of multiple levels of analysis to investigate the biological mechanisms underlying complex sociocognitive processes [5]. It builds on insights from evolutionary theory, comparative psychology, developmental psychology, individual differences, behavioral economics, and cognitive neuroscience to contribute to theoretical clarity in understanding **justice motivation** and **justice sensitivity**.

Over the past decades, social neuroscience has begun to identify widespread brain areas and neural networks that are critical to social cognition and complex decision-making (Figure 1). Insights about the role of these computational systems in emotion, cognition, and behavior related to fairness, blame, punishment, and moral judgment are important guides for identifying underlying component processes of justice motivation [6–9]. For instance, justice motivation might arise from two complementary routes: a rapid, heuristic-based one that is often (but not always) affectively laden, and a slower, systematic one characterized by cognitive deliberation [10]. Furthermore, linking individual differences in justice dispositions to patterns of brain activity, functional connectivity [11], or the spatiotemporal dynamics of neural processing during moral evaluations [12] can distinguish between competing hypotheses about which specific computations underlie justice motivation as well as characterizing when in time justice dispositions influence such processing.

Trends

From an early age, individuals are motivated by considerations of justice such as fairness and equity for both themselves and for others. However, people differ in their propensity to detect and react to injustice.

Justice motivation involves fast, heuristic computations as well as controlled, deliberative ones.

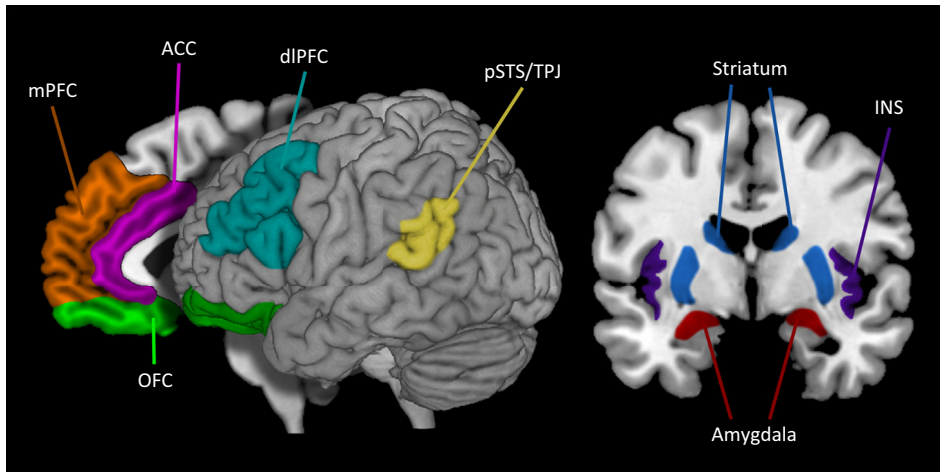
The processes underlying sensitivity to injustice for oneself and injustice for others are partially independent and sometimes exert opposing influences on behavior.

Social neuroscience, by articulating multiple levels of organization across disciplines, is well suited to the identification of specific stages of information processing and circuits engaged in social cognition and decision-making that are susceptible to self-focused or other-focused justice sensitivity. Characterizing these influences contributes to a better understanding of how conflicting justice concerns influence decision-making and behaviors in human society.

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Trends in Cognitive Sciences

Figure 1. Specific Brain Areas that Support Social Decision-Making. Studies in social neuroscience converge with neuroeconomics in identifying a network of brain regions involved in evaluations of fairness, justice, and moral judgment. Extensive evidence from lesion and functional neuroimaging studies points towards a core valuation network (reviewed in [6]) in which stimulus–outcome and response–outcome representations are maintained by computations in the orbitofrontal cortex (OFC). These signals are updated by the amygdala, striatum, anterior cingulate cortex (ACC), and anterior insula (INS) and integrated primarily in the ventral medial prefrontal cortex (mPFC). In social contexts the mPFC and the posterior superior temporal sulcus extending into the parietal lobes (pSTS/TPJ) support the representation of others' goals and beliefs. Finally, the dorsolateral prefrontal cortex (dlPFC) plays a significant role in response selection [6–9].

Another important theoretical aspect of justice motivation is the extent to which there are symmetries or asymmetries in neural responses, cognition, and behavioral outcomes when individuals experience first-person injustice or observe third-party injustice [13,14]. Personal involvement should naturally evoke self-serving biases and so it would be unsurprising if individuals are more sensitive to issues of fairness for themselves than for others [15]. In addition, people possess a need to belong and are motivated to maintain affiliative bonds with social groups [16]. Therefore, as long as self-interest coincides with group interest the two core motives do not conflict. Alternatively, some have argued that justice is itself a fundamental motive that can compete with other motives to influence behavior [17]. A social neuroscience perspective is can contribute in distinguishing the respective roles of these motives, because subtle changes in neural function and connectivity of which individuals are unaware can identify proxies of specific and distinct cognitive functions.

Evolutionary Roots of Justice Motivation

A full understanding of a behavioral phenomenon requires multiple levels of analysis. For instance, proximate explanations examine the mechanisms that drive individuals to make decisions. By contrast, ultimate causes focus on the selection pressures that have shaped cognition and behavior to respond adaptively to social interactions. However, because organisms are not consciously trying to increase their evolutionary fitness, ultimate and proximate causes may be decoupled. Thus, examining components of justice motivation across species can identify ecological contexts that have favored the emergence of justice motives and distinguish which components of justice motivation have evolved independently.

Several lines of research suggest that the precursors to justice motivation have evolved in the ecological context of pressure to stabilize cooperative groups. Several primate species demonstrate **inequity aversion** and respond negatively to receiving less reward than a social partner [18]. Studies with macaques have begun to map neural populations that are important for distinguishing between beneficial and detrimental distributions and social partners, including

Glossary

Equality: all parties receive the same outcome.

Equity: invested parties receive outcomes that may not be equal but are proportional with respect to need, effort, or merit.

Fairness: social norms about distributions and procedures that incorporate effort, merit, and need.

Inequity aversion: negative reactions to situations that are not perceived equitable.

Justice: a system of normative rules and principles concerning the impartial allocation of rights, responsibilities, and resources in society.

Justice motivation: people's tendency to prefer justice and strive for justice in their own life and the lives of others.

Justice sensitivity: an individual's predisposition to perceive and react to injustice.

Life-history analysis: investigation of how natural selection shapes the timing of key events in an individual's life.

Morality: social norms prescribing and prohibiting certain behaviors.

Ontogeny: accounts for an individual's developmental history.

Prosocial behavior: any action performed by one organism to alleviate another's need or improve their welfare.

the striatum [19,20] and lateral prefrontal cortex (PFC) [21]. One such study found a unique role for the dorsal anterior cingulate, where neurons encoded a partner's decision, including a subpopulation of cells that predictively encoded future decisions [22] indicating that these neurons play an important role in predicting conspecifics' intentions [23]. Interestingly, among primates inequity aversion has been observed only in species that regularly cooperate with non-kin, suggesting that inequity aversion may have evolved as a means of motivating individuals to adhere to mutually beneficial outcomes in social groups that are genetically heterogeneous [24]. Additionally, corvids (e.g., crows, ravens) demonstrate inequity aversion, implying that evolution favors the independent emergence of inequity aversion in any species that engages in repeated cooperative interaction and possesses sufficiently complex cognitive abilities [25].

Moreover, if justice motivation is one facet of what make *Homo sapiens* an ultracooperative species, social decision-making related to justice issues, like prosocial decisions, may be driven by the anticipation of reward [26]. The value attached to justice may be established in the brain's reward system, which receives input from a cognitive control system computing the benefits to the self, and a social cognition system, which is sensitive to subtle social information regarding the cooperative intentions of others [6,7]. There is evidence that humans find aspects of justice inherently rewarding [27] and derive hedonic value from mutual cooperation [28]. Once established as a value, justice can serve as a compass to guide people as they navigate through the social world.

While investigations in comparative psychology and evolutionary biology are crucial for understanding the ecological and neurocognitive requirements of justice motivation, it is important to note that the components necessary for the emergence of justice sensitivity are not sufficient by themselves to constitute full-blown justice motivation as seen in humans [29]. For instance, in addition to inequity aversion, third-party altruistic punishment is ubiquitous in human societies and less common in other species. Some species like cleaner fish even exhibit third-party punishment without inequity aversion [30]. Furthermore, mature human justice motivation relies on appeals to objective abstract principles that are established and reinforced by social institutions [24,31]. These social norms are distributed and transmitted among individuals within each culture.

Developmental Emergence of Justice Motivation

There is accumulating evidence that expectations about fairness and equality arise early in infancy. Infants and young children show an ability to identify variations in fairness and a general tendency to preferentially approach justice and dislike or avoid injustice [26,32–34]. Similarly, studies utilizing violation of expectancy paradigms indicate that during the second year of life infants expect equal distributions of resources and even demonstrate merit-based reward expectancies [35,36]. Importantly, infants show wide variability in their sensitivity to fairness and in their **prosocial behavior**, and the former predicts the latter [32,35,34]. These findings mirror the adult literature (e.g., [37]) and suggest that individual differences in justice sensitivity may have deep ontogenetic roots. Importantly, new research suggests that parental transmission of justice-related values is detectable in electrophysiological evoked responses (ERPs) of children as young as 12 months when they observe morally laden scenarios [32]. Twin and sibling studies suggest that both environmental and genetic factors contribute to children's prosocial behavior [38]. However, a recent meta-analysis conducted on a wide range of traits across 39 countries indicates a strong influence of genes (typically near 50%) and less influence of shared environment [39].

Moreover, developmental behavioral economics research shows that sharing increases with age [40]. While this general pattern has been documented across many cultures [41], there are interesting variations in the onset of the responses to advantageous and disadvantageous inequity [42]. It is around the fourth year that children take into account merit and wealth when

distributing resources [43,44]. The mismatch between competent infant social evaluation and relatively limited early childhood ability to distribute goods in a fair and equitable manner may be unsurprising. **Life-history analysis** of the differing benefits of moral behavior at different ages suggests that, in contrast to moral behavior, the social evaluation of others requires little cost and can be beneficial to infants [45]. As a result, natural selection has favored earlier developmental emergence of third-party social evaluation than of moral behavior. This account fits with other, neuroimaging studies where children do not appear to integrate relational information into their decisions to behave prosocially until middle adolescence [46] despite showing adult-like patterns of neural activity in the temporoparietal junction (TPJ), medial PFC (mPFC), and anterior cingulate cortex (ACC) during social economic games [47–49].

Justice Sensitivity as a Personality Trait

Social justice research has documented stable individual differences in sensitivity to issues of justice in adults [4,13,50] as well as adolescents and children [51]. A host of behavioral studies has linked justice sensitivity to generally enhanced processing of justice-related information such as lower activation thresholds, conceptual elaboration, and better memory recognition for justice-related items [14,52,53]. Emotional reactions have been argued to motivate such effects. However, sensitivity towards experiencing injustice and observing injustice often exerts opposing influences on perceptions and behaviors [54]. For this reason, self-oriented and other-oriented justice sensitivity have been argued to reflect somewhat independent processes [4]. Other-oriented justice sensitivity can be further differentiated into partially distinct perspectives depending on whether an individual personally benefits from the injustice ('beneficiary sensitivity'), performs the injustice ('perpetrator sensitivity'), or is a neutral third party ('observer sensitivity'). Self-focused and other-focused sensitivity also appear to follow different developmental trajectories. In one study of 10–17-year-olds, self-focused sensitivity was positively correlated with age while the trait other-focused sensitivity remained relatively constant [51]. Interpreting such findings requires caution, because most of the evidence for age-related changes and stability comes from cohort comparisons rather than longitudinal comparisons. However, latent state–trait analyses of responses one or two years apart suggest that justice perspectives increase in stability from childhood into adolescence, but then other-oriented perspectives in the late teens [55]. At the same time, correlations between justice perspectives in late adolescents also decrease, which may indicate greater differentiation and more fine-grained cognitive representations of justice.

However, there is also evidence that self-oriented sensitivity may not only reflect sensitivity to justice and may instead be better characterized as a specific asymmetrical sensitivity to untrustworthiness cues [56,57]. Whereas individuals with high other-oriented sensitivity show increased generosity and persist in cooperative behavior even when others behave selfishly [58–60], individuals with high self-oriented sensitivity are less generous and stop contributing to public goods at the slightest cue that others might defect [37,54]. Indeed, some recent conceptions of justice sensitivity as a personality trait have argued that other-oriented sensitivity reflects genuine prosocial motivation and concern for justice as a moral principle. Self-focused sensitivity additionally includes self-interested concern for oneself, potentially driven by a learned fear of exploitation [4,61,62]. Careful research is still required because self and other justice perspectives correlate with each other and so it is not always possible to reliably tease apart their distinct influences [13,63].

Empathy is an obvious candidate to motivate other-oriented justice sensitivity. However, it is important to distinguish different facets of empathy and their respective contributions to cognition and social behavior [64,65]. Notably, some aspects of empathy can compete with moral judgment and justice principles; for instance, by inducing partiality for ingroup members [64]. One study specifically investigated the links between justice sensitivity and the cognitive,

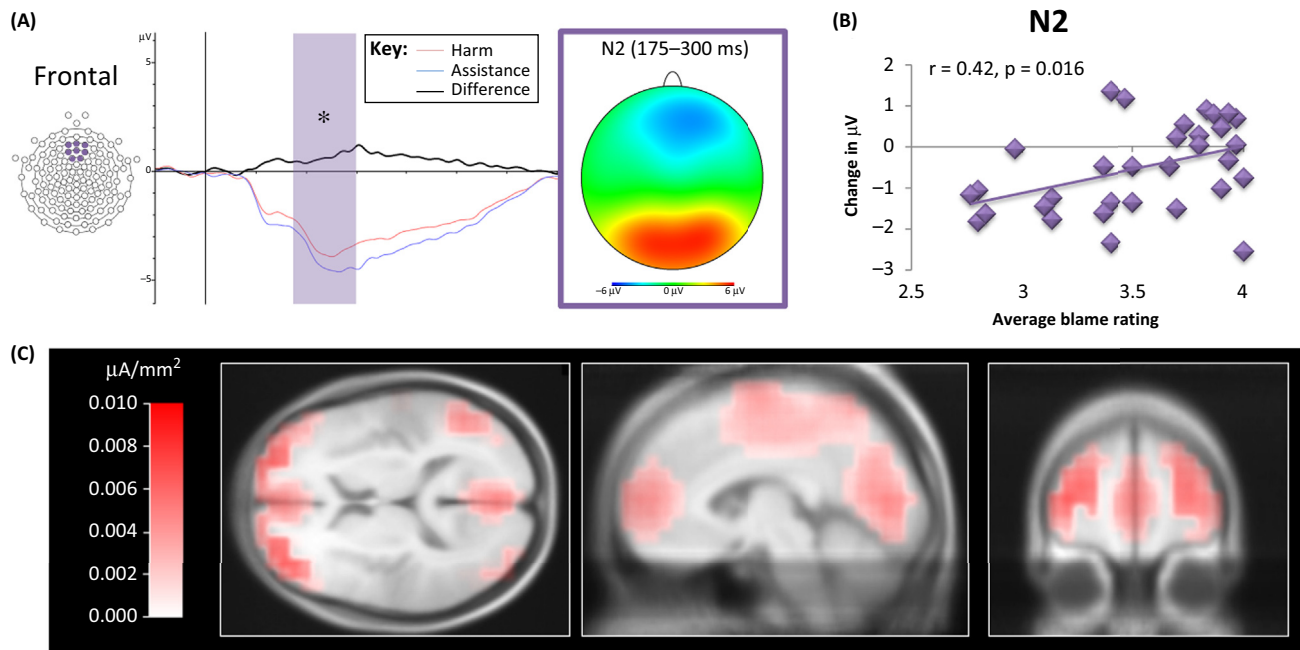
motivational, and affective components of empathy [61]. Cognitive and motivational empathy, but not affective empathy, predicted other-oriented justice sensitivity as well as the endorsement of moral rules. This suggests that individuals that are particularly sensitive to injustice are motivated by justice principles rather than swayed by emotional contagion and personal distress. This is true even in the context of physical pain. One study found that when financial incentives can be exchanged for painful shocks, individuals may value the pain of an anonymous third-party more than their own pain [66]. Notably, participants who were more 'hyperaltruistic' (paid more to diminish others' pain than their own) had longer reaction times to decide when their choices affected others. These slower responses possibly reflect the computation of moral responsibility for outcomes affecting others but not for decisions affecting themselves. Taken together, such studies highlight the importance of cognitive processing and deliberation in prosocial behavior when decisions may harm others.

Justice and Morality

Justice and morality are closely related and sometimes equated with each other. Both hold central importance in human societies and are arguably fundamental aspects of human nature [2]. Despite varying interpretations, morality usually refers to how individuals treat others, not only themselves, and encompasses both individuals' intentions and their behaviors [67]. Justice is primarily concerned with outcomes. People generally condemn deviations from justice as morally wrong, recommend punishment for violating justice principles, and strive to behave in accordance with such principles themselves [1].

Affective and cognitive neuroscience has made progress in identifying brain networks involved in evaluations of fairness and morality (Figure 1). Converging evidence suggests that the complex social information processing involved in justice judgments, as well as the remarkable human capacity for creating cultural institutions devoted to enforcing social norms, relies on more basic neurocognitive systems for value learning, decision-making, and perspective-taking [7]. Understanding variation in such networks may help us answer questions about why some individuals are more sensitive to justice issues. There is extensive heterogeneity in social values and justice dispositions can be tracked by idiosyncratic activation patterns in response to morally laden scenarios (Figure 2). For instance, one functional neuroimaging study found that the trait justice sensitivity predicted the amount of subjective blame assigned to perpetrators [11]. Moreover, justice dispositions in that study were specifically associated with increased activity in regions implicated in cognitive control and mental state understanding, such as the TPJ, dorsomedial PFC (dmPFC), and dorsolateral PFC (dlPFC), rather than regions primarily involved in affective reactions (Figure 3). Such findings are theoretically important because they cast doubt on the notion that justice motivation mainly influences moral decision-making via increased negative affective arousal.

As discussed above, developmental psychologists have documented that sensitivity to fairness emerges early in **ontogeny** and is related to actual prosocial behavior [35]. More recently, developmental neuroscientists have begun to investigate the neural mechanisms underlying the emergence of morality and justice-related behaviors in infants and toddlers. Such investigations indicate that during the second year of life domain-general processes such as approach-withdrawal and attention contribute to very young children's ability to distinguish between prosocial and antisocial actors [32]. Crucially, children's electrophysiological responses to antisocial characters were predicted by parental sensitivity to injustice for others, providing some initial support for intergenerational transmission of values at a neural level. Another neurodevelopmental study examined implicit moral evaluations of scenarios depicting antisocial and prosocial behaviors in children (3–5 years) and whether early automatic or later cognitive controlled (LPP) processes were predictive of children's own prosocial behavior [68]. Neural differences were found in both automatic and later controlled ERPs when children viewed these scenarios. Importantly, only cognitively controlled processes predicted actual prosocial behavior.



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Figure 2. Time Course of Justice-Related Decision-Making. High-density electroencephalography (EEG) provides a means of identifying specific temporal dynamics of information processing to understand the mechanisms underlying individual differences in justice sensitivity. In one study participants made moral judgments about scenarios depicting interpersonal harm or assistance [12]. (A) The average amplitude of N2 (negative voltages around 200 ms post-stimulus) at frontal sites significantly differentiated between these two categories. (B) N2 amplitude differences significantly predicted participants' subjective blame ratings of harmful perpetrators after the recording session. (C) Low-resolution electromagnetic tomography (LORETA) source estimates localized activity during the same time period to several regions including the bilateral temporoparietal junction (TPJ), anterior cingulate cortex (ACC), and ventromedial prefrontal cortex (vmPFC). Adapted from [12] with permission from Elsevier.

The Economics of Justice

Another productive line of justice-relevant research has utilized behavioral economic games to examine how individuals make decisions about and react to unfair distributions. For instance, in the Ultimatum Game [69] a Proposer receives an initial endowment and divides it with another player. This Responder decides whether to accept or reject the offer, where rejection means that both players get nothing. If people were motivated solely by self-interest, Proposers should offer very little money and Responders should accept any non-zero offer. However, a majority of Proposers offer close to 50% and a majority of Responders reject offers below 30% [70]. Moreover, this preference for distributive justice is a social expectation, because unfair offers are accepted at a higher rate when made by a computer than when made by a person [71]. Such resource distribution games are important because they allow fine-grained control over quantitative equality and equity and can be easily expanded to include neutral third parties or modified to assess the extent to which economic decision-making is influenced by a host of factors such as effort, merit, social status, or group membership.

Extensive work in neuroeconomics has already been done to identify cortical networks and regions such as the mPFC and dlPFC and neurotransmitters causally related to fairness processing in distribution games [72–75]. Recent theories now propose a social decision-making network in which domain-general valuation systems interact with systems underlying social cognition [6,70]. Similar to behavioral findings, symmetries and asymmetries in self-directed and other-directed unfairness have been observed at the neural level. Across a host of studies, the ACC, whether indexed by hemodynamic activity or by frontal scalp negativities, shows an

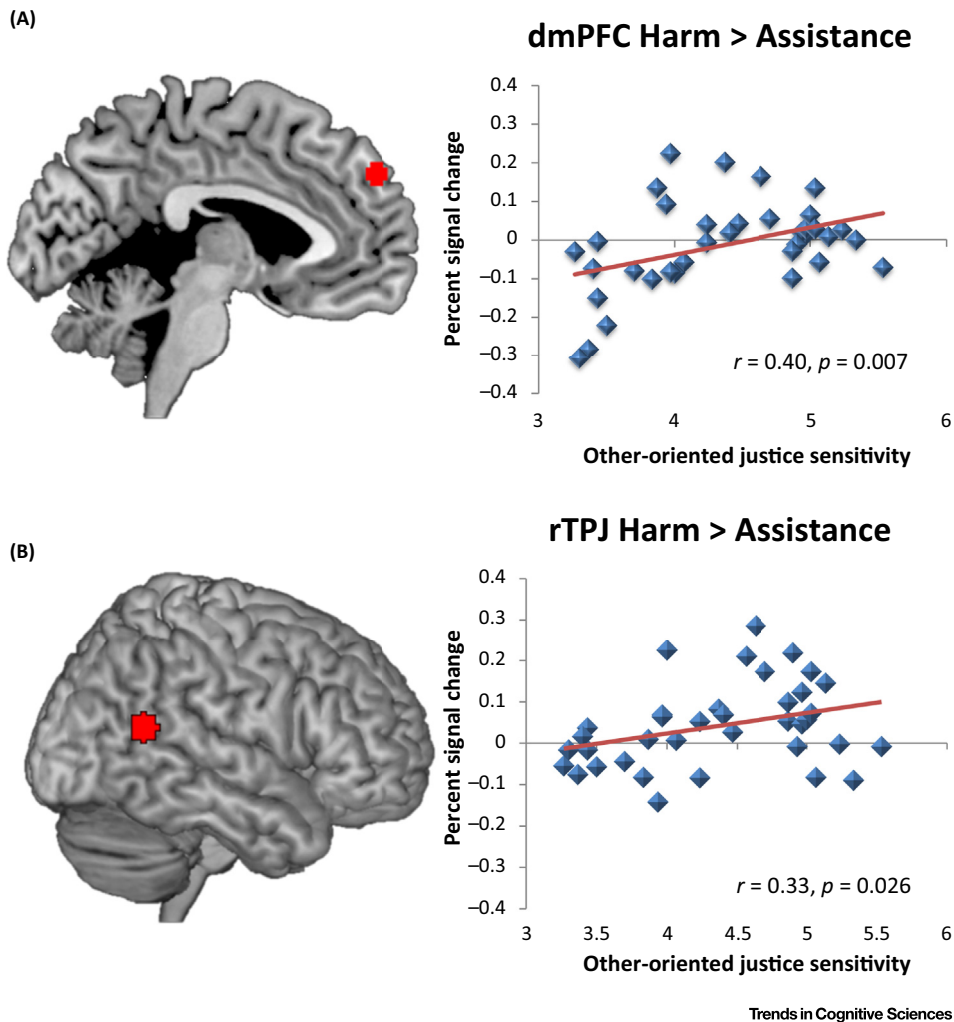


Figure 3. Other-Oriented Justice Sensitivity and Intention Understanding. This fMRI study found that, when contrasting scenarios depicting interpersonal harm versus interpersonal assistance, activity increased in regions associated with mental-state understanding – namely, the dorsomedial prefrontal cortex (PFC) (A) and the right temporoparietal junction (TPJ) (B) – in individuals with higher disposition sensitivity for the injustice of others [11]. Illustration created from previously published data [11].

enhanced response to unfair offers, specifically when making decisions for oneself [76,77]. By contrast, the anterior insula (aINS) appears to respond equally to unfairness regardless of perspective [78,79]. Such results provide further evidence for the existence of two distinct systems: one reflecting self-serving assessment supported by the ACC and mPFC and a second that appears to identify (distributive) injustice regardless of the target by invoking the aINS. Importantly, the aINS response need not reflect a purely emotional reaction to unfairness [27,71]. Instead, rejecting inequitable distributions appears to reflect a cognitive heuristic, in which case the aINS response may be driven by the violation of social norm expectations [15,77].

Concluding Remarks

Justice principles play a central role in shaping and upholding sociomoral norms across human social groups. Yet individuals vary in their sensitivity to issues of justice, and their reactions to experiencing or observing injustice arise from partially separate processes. Much has already been accomplished at the intersection between psychology, moral neuroscience, and

Outstanding Questions

Social species self-organize into hierarchies where individuals vary in their level of power, influence, or dominance. To what extent do social status and dominance modulate the relationship between justice motivation and responses to injustice? Does social ranking differentially impact self- and other justice sensitivity?

When justice concerns and self-interest are in conflict, what factors determine whether an individual ultimately chooses to behave in accordance with justice principles?

To what extent is justice motivation modulated by the need to belong and the need to increase affiliation with social groups?

Is interindividual variability across different measurement domains (e.g., dispositions, behavior, brain processes) driven by a single dimension that reflects a genuine sensitivity to justice? Or are there several distinct systems that operate only at particular levels of analysis?

How malleable is justice motivation across the lifespan? Are early individual differences found in infants' sensitivity to fairness predictive of justice-related sensitivity in adulthood?

Do specific social experiences of injustice trigger lasting changes in justice sensitivity?

Which neural systems must come online before justice sensitivity stabilizes? Are there critical periods for acquiring justice sensitivities and, if so, do they differ depending on whether the injustice is directed at the self or another person?

neuroeconomics, but several questions remain (see Outstanding Questions). Through an interdisciplinary effort from cognitive neuroscientists, behavioral economists, developmental psychologists, and social psychologists, it will be possible to reveal the latent drivers of justice motivation, corroborating the interplay of both fast, heuristic-based input and more controlled processes that influence conscious deliberations. These investigations are crucial for understanding the extent to which justice plays a role in everyday interactions and decision-making. Such knowledge has the potential to illuminate our understanding of one of the most fundamental and valuable characteristics of human social behavior that plays a concrete role for all members of our species.

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