Fairness and Cooperation Are Rewarding

Evidence from Social Cognitive Neuroscience

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ABSTRACT: To motivate their consumers or employees, corporations often offer monetary incentives, such as cash-back deals or salary bonuses. However, human behavior is not solely driven by material outcome; fairness and equity matter as well. In a recent neuroimaging study, fair offers led to higher happiness ratings and increased activity in several reward regions of the brain compared with unfair offers of equal monetary value. Other neuroimaging studies have similarly shown activation in reward regions in response to cooperative partners or cooperative play. Here, we review these findings and discuss the implications for organizational settings.

KEYWORDS: neuroeconomics; fairness; cooperation; reward; monetary incentives; equity; social factors

INTRODUCTION

Money is widely used as a reward and motivator. Employees are rewarded for good performance by raises in salary or by a bonus, consumers are lured to buy products by cash-back offers and price reductions, and children are coaxed to do unwanted chores by the promise of extra allowance. Although money and other material goods are unquestionably rewarding, in recent years interest has increased in the study of nonmaterial social factors that may also serve as hedonic inputs to individuals' behaviors. These studies have shown that the social context in which material resources are gained also matters. We live in a highly social environment, in which most of the work we do is accomplished through collaboration with others and many of the goods we consume are consumed in the company of others or shared with others. Thus, our labor and the fruits of our labor are differentially satisfying depending on the relative effort exerted and the relative rewards reaped by our peers.

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The role of money and equity in motivation and welfare has been extensively studied in the past by psychologists, economists, sociologists, and anthropologists, typically through survey methods and behavioral experiments. A number of studies have examined the separate impact of fairness on positive and negative emotions and have found substantial increases in self-rated positive emotions associated with fair treatment, even after controlling for material outcomes.[1–3] In fact, both survey and experimental data indicate that individuals often experience negative emotions if they are the beneficiaries of unfair resource distribution.[4,5] Similarly, voluntary cooperation has been associated with self-reported pleasure and satisfaction.[6,7] Altogether, these studies suggest that fairness and cooperation produce self-reported positive emotions.

Although survey and self-report techniques are important research tools, their value is limited, because participants may not always know or want to disclose the true state of their emotions. Technological advances in neuroimaging, however, have recently allowed for an additional method of studying motivation. Instead of relying on self-report or behavioral measures to gain insight into what people find rewarding, many studies now use functional magnetic resonance imaging (fMRI) to directly peer into the brain and determine which types of incentives activate regions of the brain associated with motivation and reward. In the social cognitive neuroscience approach, neuroimaging techniques are combined with more traditional experimental and survey methods to gain a better understanding of social and affective processes.

In this paper we review studies that employed a social cognitive neuroscience method to investigate the affective impact of fairness and cooperation in collaborative settings. We defined fairness as the equitable distribution of goods or outcomes (e.g., money), and we defined cooperation as doing one's share to maximize public goods rather than working individually to maximize personal goods. In most of these studies, neural activity in each subject was measured during tasks in which the outcome relied on how the subject interacted with a partner. These tasks typically included the ultimatum game, prisoner's dilemma, or trust games. In the following section, we briefly describe each of these tasks. Then, after a brief review of the social cognitive neuroscience approach, we review the findings from neuroimaging studies of fairness and cooperation.

ECONOMIC EXCHANGE GAMES

In the ultimatum game, two players must agree to split a sum of money, known as the stake, or neither player gets anything. The proposer, who is endowed with the stake (e.g., $10), must suggest a way to split it with another player, the responder (e.g., the proposer could offer to give $2 to the responder and keep $8 for himself). If the responder accepts, each player receives the amount allocated by the proposer. If the responder rejects the offer, neither player receives any money. Numerous studies using the ultimatum game have shown that responders do not maximize monetary payoff by accepting every offer; rather, they typically reject unfair offers ($<20\%$ of the total stake). These effects occur even when there will be no future interactions with the partner,[8] suggesting that fairness (or unfairness) matters to responders. By examining the responder's brain during presentation of fair or unfair offers, we can gain insight into the type of emotional responses that fairness might elicit.

In the prisoner's dilemma, each of two players independently chooses to cooperate or defect, and each player is paid according to the combination of the two decisions. The four possible combinations are: (1) both players cooperate (CC), (2) player A cooperates and player B defects (CD), (3) player A defects and player B cooperates (DC), or (4) both players defect (DD). The payoffs are arranged such that for player A, $DC > CC > DD > CD$ (e.g., $DC = \$3$, $CC = \$2$, $DD = \$1$, $CD = \$0$). Critically, no matter how player B responds on a given trial, player A will earn the most if she defects. If player B cooperates, player A earns more by defecting ($DC > CC$); and if player B defects, player A still earns more by defecting ($DD > CD$). At the same time, the outcomes are arranged so that the highest earning for the two players combined results from both individuals cooperating ($CC + CC > DC + CD > DD + DD$). Thus, mutual cooperation is the best strategy for the team collectively, but it requires giving up some personal earnings and potentially a great deal of earnings if the other player defects.

Trust games also tap into cooperation and typically involve two players. The investor is endowed with a sum of money (e.g., \$10) and can either keep it all to herself or turn some or all of it over to the trustee, in which case the trusted money multiplies (e.g., by a factor of three to \$30). At this point, the trustee can either defect and keep the multiplied sum or cooperate and return some (e.g., \$15) to the investor. In single-shot versions of this game, the investor's behavior is a measure of trust, while the trustee's behavior is a measure of trustworthiness and fairness. In iterated versions of the game, both partners' behaviors also measure cooperation.

SOCIAL COGNITIVE NEUROSCIENCE APPROACH

Social cognitive neuroscience[9,10] investigates social psychological phenomena using cognitive neuroscience tools such as neuroimaging and neuropsychological testing of patients with lesions. These tools offer insight into cognitive and affective processes that behavioral or self-report measures alone may not offer. For example, in an fMRI study investigating whether social rejection elicits feelings of pain akin to physical injury, Eisenberger *et al.*[11] scanned participants who underwent a task during which they were "ditched" by their partners in a ball-tossing game. Compared with nonsocial exclusion (i.e., inability to play because of a computer glitch), social exclusion led to increased activity in dorsal anterior cingulate cortex (ACC), the same brain region that is activated during the psychological distress of physical pain.[12] Self-reported distress after social exclusion correlated positively with ACC activity; however, the main effect of self-reported distress could not be determined because demand characteristics prevented the measurement of self-reported distress after nonsocial exclusion. Thus, not only did fMRI provide a measure of distress that would have been difficult to collect through self-report, it also further elucidated the nature of the distress by revealing common processes underlying social and physical pain.

The social cognitive neuroscience approach relies in part on prior knowledge about functional neuroanatomy. Although a given brain region generally is not exclusively involved in a single process, some patterns of results have emerged from prior research that more strongly implicate certain regions in positive emotions and other regions in negative emotions. The part of the brain most commonly associated with reward is the striatum, including the caudate, and particularly the ventral striatum, a region receiving rich dopaminergic input from the midbrain that is involved in positive reinforcement and reward-based learning.[13,14] The ventral striatum is thought to function together with the amygdala and regions of the orbital and medial prefrontal cortex (PFC) in a reward network,[15,16] with the amygdala coding intensity of reward and the orbitofrontal cortex (OFC) determining valence.[17] A proposed mediolateral distinction in the OFC suggests that medial portions of this region tend to decode rewarding reinforcers, and lateral regions monitor punishing reinforcers.[18] The ventromedial prefrontal cortex (VMPFC) seems particularly involved in preference (e.g., for a preferred brand of drinks).[19,20]

The canonical brain region associated with negative emotional processes, particularly fear, is the amygdala.[21] However, an increasing number of studies now link this region to positive affective processes as well,[22] such as viewing attractive faces.[23] Activity in the anterior insula has also been associated with aversive experiences, such as exposure to a disgusting odor or taste,[24,25] although this region is more generally regarded as the primary sensory cortex for visceral information, including autonomic arousal.[26] The dorsal ACC is another region commonly associated with unpleasant experiences, such as the emotional aspect of physical[12] and social[11] pain. The rostral ACC, on the other hand, has been associated with induced emotions of positive or negative valence.[27]

Notwithstanding the advantages of a social cognitive neuroscience approach, it is important to note that a reverse inference problem exists with studies inferring a cognitive or affective process from neural activation.[28,29] Specifically, because each brain region is involved in more than one process, we cannot confidently infer from the observation of increased signal in a region that activity in that region evoked one mental process rather than another. However, our confidence in the reverse inference could be increased in two ways:

(1) convergence of evidence from multiple techniques and (2) activations in two or more regions thought to underlie the same mental process, particularly if those regions are known to work together in a network.

FAIRNESS IS REWARDING

Numerous behavioral and self-report studies using the ultimatum game have established that people dislike unfair treatment. For example, as stinginess of an offer relative to the stake size increases, a self-reported feeling of contempt also increases, as does the likelihood to reject the offer.[30] Similarly, unfair offers that are rejected tend to elicit activity in the anterior insula, and the more likely a person is to reject unfair offers, the more activity this insula region exhibits.[30,31]

Although evidence suggests that receiving an unfair proposal may be related to negative emotional responses, until recently it was unclear whether fair offers produced positive emotional responses beyond those associated with the monetary payoff that is associated with fair offers. In everyday life, being treated more equitably by another person in financial transactions is typically confounded with better financial outcomes for oneself. To control for monetary payoff, we varied both the offer amount and the stake size across trials,[30] such that the same offer amount could appear as a large percentage of the total stake ($2 out of $4), and therefore fair, or as a small percentage of the total stake ($2 out of $10), and therefore unfair. If fair treatment is experienced as rewarding, then people should report more happiness with a fair offer compared with an unfair offer of the same monetary value. Similarly, brain regions associated with reward should be more active during fair treatment than during unfair treatment, after controlling for monetary payoff. Indeed, we found that fair offers led to higher happiness ratings and increased activity in several reward regions of the brain, including the ventral striatum, OFC, VMPFC, and left amygdala, compared with unfair proposals of equal monetary value.

Fairness can be experienced either directly, by fair behavior from one's partner, or indirectly, when an unfair partner is punished. Punishment of an unfair partner in effect brings about justice and greater equality in outcome. In an fMRI study of the trust game,[32] investors were given the opportunity to punish uncooperative and selfish trustees. Deciding to punish a selfish partner by removing some of his or her earnings increased activity in the caudate nucleus—even though the participant did not gain any money by punishing. Moreover, increased activity in this region was associated with harsher punishments. As the authors explained, given the role of this region in processing accruing rewards for goal-directed actions, these results suggest that people derive satisfaction from implementing justice and maintaining fairness by punishing unfair partners.

This indirect pleasure of fairness was also investigated in a creative study by Singer and colleagues,[33] who studied empathy toward former interaction partners who had played fairly or unfairly. In this study, participants played the ultimatum game with a fair and an unfair proposer. Later, while in the MRI scanner, participants watched as each partner appeared to receive painful stimuli. While viewing fair partners who appeared to be in pain, men and women both exhibited increased activity in insular and anterior cingulate regions, suggesting an empathic response for pain. This finding suggests that people like and are sympathetic toward those who have previously treated them fairly. Interestingly, Singer *et al.* also found that when men (but not women) watched *unfair* proposers receive pain, activity increased in reward regions, such as the ventral striatum. This latter finding shows that the establishment of justice, through punishment of unfair behavior, may elicit positive feelings.

COOPERATION IS REWARDING

The first fMRI study of cooperation, in the trust game, was by McCabe and colleagues[34] who instructed participants to play as the investor in half the games and as the trustee in the other half. Although the study was designed to identify prefrontal regions associated with theory of mind, rather than to link reward with cooperation, it is worth mentioning that the investigators found increased activity in the medial thalamus and right medial frontal pole, during decisionmaking in cooperative players when they played against humans rather than computers. Although neither region is uniquely linked to reward, the thalamus is considered part of the emotion network known as the limbic system, and the right medial PFC, though primarily involved in cognitive integration,[35] has also been associated with approach-related behaviors.[14] These results are not inconsistent with the premise that cooperation has an affective component.

Decety and colleagues[36] were the first to explicitly link cooperation with reward-related neural activity. Rather than using an economic exchange paradigm, the authors used a specially designed computer game in which a participant in the MRI scanner had to arrange a visual pattern following certain rules, in cooperation with another player, in competition with another player, or alone. Compared with working alone, cooperation and competition both led to increased activity in the anterior insula, potentially reflecting increased autonomic arousal. Importantly, cooperation led to more activity in medial OFC than competition, suggesting that cooperation is a rewarding process.

In an innovative fMRI study by King-Casas and colleagues,[37] the brains of investors and fellow trustees were simultaneously scanned, or “hyperscanned,” while they played an iterated version of the trust game with each other. Because participants played multiple rounds with one another, the investigators were able to study the development of trust over time, behaviorally and neurally. They found that trustees cooperated depending on their partner’s “reputation” or behavior on previous rounds. When an investor was generous following a defection by the trustee, the trustee rewarded this benevolent reciprocity with a larger repayment. Similarly, when an investor was stingy following cooperation by the trustee, the trustee punished this malevolent reciprocity by reducing the repayment. In the trustee's brain, the only region that was more active during benevolent reciprocity than malevolent reciprocity was the caudate nucleus, a region implicated in reward-based learning. Furthermore, the magnitude of this response correlated with the amount repaid by the trustee. The authors interpreted activity in this region as the response to perceived fairness of the partner's behavior, as well as the intention to cooperate and repay benevolent behavior with trust.

Mutual cooperation has been linked with reward-related neural response during other tasks as well. In an iterated version of the prisoner's dilemma in female participants, the ventral striatum, rostral ACC, and medial OFC were activated more by mutual cooperation outcomes than by outcomes of equal monetary payment in a nonsocial context.[38] Consistent with King-Casas *et al.*,[37] they also found neural overlap between the pleasure of being treated fairly and that associated with the intention to cooperate; activity in rostral ACC and ventral striatum also increased during the part of the trial when participants decided to cooperate, prior to finding out the outcome of the trial. Thus the reward of behaving cooperatively may be intertwined with the reward of receiving cooperative treatment. Rilling and colleagues[39] replicated these results in a subsequent study using the single-shot version of the prisoner's dilemma, in which they found neural activity in VMPFC and ventral striatum to increase with reciprocated and decrease with unreciprocated cooperation.

In an interesting version of the trust game, Delgado *et al.*[40] influenced investors' decisions by giving them character descriptions of fictitious trustees who were depicted as either noble, neutral, or of questionable moral character (i.e., good, neutral, or bad). Despite equivalent repayment by all trustees, participants tended to trust the good trustees the most. Consistent with previous studies suggesting that cooperation is rewarding, deciding to "share" (i.e., trust) versus "keep" increased activity in the ventral striatum and anterior insula. Interestingly, the opposite comparison did not activate any reward regions, despite the fact that keeping an endowment is a guaranteed monetary payoff. Further analyses indicated that the increased striatal response during share versus keep decisions occurred only with bad or neutral partners, suggesting greater reliance on reward-based learning with ambiguous partners than with partners who have already left a good impression.

This is not to say, however, that being around cooperative and moral people is not rewarding. The pleasure of being exposed to cooperative people was directly studied by Singer and colleagues,[41] who showed participants the faces of partners who had cooperated or defected in multiple rounds of the prisoner's dilemma they had played together earlier. To vary moral responsibility, some partners were introduced as "intentional agents," who freely chose whether to cooperate, and some as "nonintentional agents," who had no choice. Faces of cooperators, regardless of intention, were rated as more likable than neutral faces; and faces of defectors, particularly intentional defectors, were rated as less likable than neutral faces. Viewing faces of intentional cooperators activated bilateral insula, bilateral OFC, bilateral ventral striatum, and left amygdala. Although this study was not optimally designed for examination of responses to faces of defectors, we do know from an earlier study that, as expected, faces of people judged to be untrustworthy activate bilateral amygdala.[42] Thus, positive feelings (and absence of negative feelings) seem not only to be associated with receiving fair treatment and with cooperation, but also with the people who are cooperative and trustworthy.

IMPLICATIONS AND CONCLUSION

Multiple studies have demonstrated that, even without additional monetary gain, fairness or cooperation leads to self-reported, behavioral, and neural evidence of reward. Until recently, studies of the emotional impact of fairness and cooperation relied mainly on behavioral and self-report techniques, which limited ways in which positive emotional experience could be measured. For example, in studies of the ultimatum game, the emotional experience of the responder has often been inferred from his tendency to reject unfair offers; this rejection is thought to reflect unhappiness with unfair offers. However, the opposite side of the coin, happiness as a result of fair offers, has typically been ignored in these studies. Thus, investigations of emotion in economic exchange often focused on the aversive aspects of unfairness and defection, rather than the rewarding aspects of fairness and cooperation.

The tendency for people to prefer equity and resist unfair outcomes and partners is deeply rooted. This "inequity aversion" is so strong that individuals are willing to sacrifice personal gain to prevent another person from receiving an inequitably better outcome.[43] Inequity aversion plays an important role in organizational settings. Perceived inequity in income or exerted effort can dampen employee morale and performance.[6,44,45] Conversely, perceived equity may have the opposite effect and improve employee morale.

Why would humans be built to be sensitive to fairness? It has been suggested that forming secure social bonds is a fundamental human need.[46] Humans have evolved to operate socially, from infancy, when the social connection to parents is critical for survival; to childhood, when learning is accelerated by the transmission of accumulated human knowledge; and to adulthood, when access to food and mating partners depends on social inclusion. Cues that indicate social acceptance may thus be highly rewarding because of the other resources to which they facilitate one's access. Being treated fairly by others may serve as a strong cue of acceptance and thus come to be experienced as intrinsically rewarding in itself.

Consistent with the idea that fairness and cooperation are intrinsically rewarding, the reinforcing effects of fair treatment and cooperation seem to be both ubiquitous and primitive. Fairness preference is evident across cultures[47] and in children,[48] and even capuchin monkeys seem to compare payoffs with peers and react negatively when a peer is rewarded more handsomely for the same effort (see also 49).[50] Recent evidence also suggests that fairness preference may be partly heritable.[51] There is also evidence that rodents prefer cooperation to working in isolation for the same reward.[52] Thus, it is possible that social reinforcers, such as fair treatment and cooperation, are more likely to increase intrinsic motivation, whereas monetary payoff tends to elicit extrinsic motivation. Previous work has shown that increased intrinsic motivation predicts better job performance and satisfaction.[53,54]

Similarly, given that fairness and cooperation lead to increased activity in brain areas associated with reward and positive reinforcement learning, it is conceivable that a work environment imbued with camaraderie and fairness would motivate and mobilize employees to continue the hard work that has been so rewarded. Consistent with this idea, in a behavioral study of the ultimatum game, proposers who reported greater pleasure associated with fairness than with payoffs were more likely than other players to cooperate and give fair offers.[7]

Perceived fairness may also have a profound impact on consumer satisfaction,[55] one of the indicators of a company's health. A recent meta-analysis indicated that, among several predictors of customer satisfaction, equity (fairness judgment in reference to what other consumers receive) was most strongly related to satisfaction.[56]

In short, this review supports the notion that money is not the only motivator. At some level, this is obvious: various maxims have been passed down over centuries warning of the shortcomings of material wealth (e.g., "money can't buy happiness"), and no one would argue that people care about being treated fairly. However, it is rare that issues of fairness and cooperation figure into discussions of promoting organizational productivity and corporate earnings. Nations measure gross domestic product, economists measure consumer confidence, corporations calculate net worth, and employees are keenly aware of their salaries, often with an underlying assumption that these numbers indicate something about public welfare and individual well-being. Surely, these factors play an important part in well-being; however, the fact that fairness and cooperation activate the same hedonic regions of the brain as financial gain is an indication that these factors may merit equal consideration in the structuring of organizational settings.

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