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# The association between punishment and cooperation in children with high-functioning autism

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ABSTRACT

This study examined judgment about punishment and whether punishment promoted cooperation in the prisoner's dilemma game (PDG) in children with high-functioning autism (HFA) and typically developing (TD) children. In total, 66 6- to 12-year-olds participated in this study. Children were first asked about judgments regarding rewards and punishment in stories, and then they were asked to play the PDG with a partner in conditions with and without punishment. Results showed that children with HFA believed that hitting others should deserve punishment to a greater extent than TD children did. It indicated that children with HFA understood that bad acts should be punished, suggesting that these children have already acquired the general concept of "punishment." Children displayed higher levels of cooperation in the condition with punishment than in the condition without punishment in the PDG, suggesting that punishment promoted cooperation in the PDG in both children with HFA and TD children.



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## Introduction

Cooperation, which is central to both human existence and human life, can be defined as two or more individuals acting together in order to pursue a common goal (Argyle, 1991; Jewett, 1992). The prisoner's dilemma game (PDG), in which participants must decide whether to favor one's own immediate interest ("defect") or to pursue the mutual interest of the group ("cooperate"), has been considered as a classic paradigm for studying the emergence of cooperation between selfish individuals (Axelrod, 1984). In any given round of the PDG, a cooperator who is exploited by a defector receives only $S$ points, whereas the defector gets $T$ points; the two players receive only $P$ points if both defect and $R$ points if both cooperate (with $T > R > P > S$ and $2R > T + S$) (Nowak & Sigmund, 1993). Strategic reasoning and theory of mind are both thought to be involved in playing this social dilemma (Nowak & Sigmund, 1993; Rilling, Sanfey, Aronson, Nystrom, & Cohen, 2004). Humans cooperate on a large scale even with unrelated individuals and cooperate in many important domains, such as economics, politics, technology, and medicine, despite the absence of a formal contract. The scale of human cooperation is an evolutionary puzzle (Boyd & Richerson, 2009; Gintis, 2000). Moreover, cooperation produces mutually beneficial outcomes but may be costly for an individual. Why would an individual be willing to perform costly cooperative behavior that benefits another individual? There is plenty of work in economics explaining cooperation. Classical assumptions of economic humans (Simon, 1979) do not explain this behavior. Similarly, kin selection and direct reciprocity also cannot explain cooperation in large human groups consisting of genetically unrelated individuals in the absence of long-term relationships (Henrich et al., 2006). One alternative explanation for cooperation in large human groups is the system of reward and punishment (Oliver, 1980; Sigmund, Hauert, & Nowak, 2001). The threat of punishment (monetary or symbolic) may help to discipline free riders and promote high levels of cooperation in large groups (Fehr & Fischbacher, 2003; Fehr & Gächter, 2000, 2002; Masclet, Noussair, Tucker, & Villeval, 2003). Human readiness to punish violators of the "norm" through personal cost may be a force maintaining social norms and promoting cooperation (Fehr & Fischbacher, 2004; Fehr, Fischbacher, & Gächter, 2002; Fehr & Gächter, 2000).

Strong reciprocity theory, which refers to the willingness to sacrifice one's own resources to reward fair behavior and punish unfair behavior even if this is costly and provides no benefits for the reciprocator, typically involves punishment, especially third-party punishment (Fehr et al., 2002; Gintis, 2000). This theory posits that humans can maintain higher levels of cooperation than other species due to humans' tendency to cooperate in groups to punish people who violate group norms even if future compensation is not expected and despite the costs to their own payoffs (Gintis, 2000). Third-party punishment is assumed as the essence of social norms and greatly enhances the scope for norms that regulate human behavior because strategies involving third-party punishment are evolutionarily stable, whereas second-party punishment strategies are not stable in iterated pairwise interactions (Bendor & Swistak, 2001; Fehr & Fischbacher, 2004). Fehr and Gächter (2000) showed that punishment promoted cooperation in a public goods game and also increased the average payoff. Moreover, even unobserved punishment, which refers to the results of the punishment stage not being revealed to participants, can promote cooperation in a public goods game (Fudenberg & Pathak, 2010). These results suggest that the fear of punishment may be as effective at promoting cooperation as punishment itself.

Although there is a vast number of studies on the effects of punishment in promoting cooperation in typically developing children and adults (Fehr & Schmidt, 2001), little is known about whether punishment promotes cooperation in children with autism. Individuals with autism are characterized by impaired social motivation (e.g., social withdrawal due to low appetitive motivation or high aversive motivations) (American Psychiatric Association, 2013; Dawson et al., 2002; Grelotti, Gauthier, & Schultz, 2002). The lack of motivation for social stimuli in individuals with autism can result from different inclinations, including reduced need for social reward and/or high avoidance of social punishment (Falk, Way, & Jasinska, 2012; Kohls et al., 2013).

Autism spectrum disorder (ASD) is a neurobiological disorder that is characterized by common impairments in social communication and by restricted interests and repetitive behaviors (American Psychiatric Association, 2013). High-functioning autism (HFA) refers to the condition of