



# Comparative Analysis of Sentiments in Children with Neurodevelopmental Disorders

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## KEYWORDS

*Neurodevelopmental Disorders; Sympathy; Ethics; Penalty of Third Parties; Artificial Intelligence; Social Customs*

## ABSTRACT

*In-group favoritism is the tendency of people where, individuals tend to punish transgressors with varying intensity based on whether they belong to their own group or not. In this cross-sectional analytical study, we examine matched samples of children with developmental disorders, observing their perspectives on punishment after watching two videos in which rules are broken. Data (video 1) shows a football player from the viewer's country scoring a handball goal, while in data (video 2), a foreign player replicates the same action against the host nation. Every contestant viewed both videos, and their responses were then compared. Our proposed methods compare and analyze the data to determine player's opinions using artificial intelligence-based machine learning such as text analysis and opinion, extract on- favorable, unfavorable, neutral feelings, or emotions. In both sets of data, the autism spectrum disorder (ASD) group displayed negative emotions for both video 1 ( $M = -.1$ ;  $CI\ 90\% \text{ } -.41 \text{ to } .21$ ) and video 2 ( $t(7) = 1.54, p = .12; M = -.42; CI\ 90\% \text{ } .76 \text{ to } -.08$ ). On the contrary, the groups with attention deficit hyperactivity disorder (ADHD), learning disabilities (LD), and intellectual disability (ID) had a favorable reaction to video1 but an unfavorable reaction to video 2. Children diagnosed with ASD typically display a consistent adherence to rules, even when those breaking the rules are not part of their group. This behavior may be linked to lower levels of empathy.*



# 1. Introduction

Autism, or autism spectrum disorder (ASD), is marked by difficulties in social interaction, communication, and repetitive behaviors, varying in intensity among individuals. Autism can be diagnosed as young as 18 to 24 months old, when distinct symptoms become discernible from normal development and other developmental issues. Progress in autism research has paralleled notable advancements in global policy. In addition to worldwide awareness and advocacy, autism has benefited from progress in human rights, maternal and child health, and mental health areas. A lot of progress has been motivated by the UN Convention on the Rights of Persons with Disabilities (UNCRPD), which highlights values such as dignity, freedom, inclusion, and the acceptance of disability as a facet of human variety (Zeidan et al., 2022).

Lately, there has been increasing focus on facial emotion recognition research in children and adolescents' social cognition skills, gaining prominence these days. Emotion recognition skills play a crucial role in children's emotional and social development, closely tied to their social abilities. Comprehending facial expressions is crucial for correctly understanding individuals, guiding their actions, and responding suitably in social interactions. Hence, lacking emotional regulation can pose psychosocial challenges for children and adolescents. This skill gap commonly appears in individuals with autism spectrum disorder (ASD) (Albayrak et al., 2022).

Researchers have studied different risk factors associated with challenging behaviors in people with autism spectrum disorder. The seriousness of symptoms can forecast difficult behaviors, as more severe symptoms tend to link with increased and more challenging behaviors. Difficult behaviors in individuals with autism spectrum disorder are connected to their intellectual abilities. More severe deficits in intellectual functioning are associated with higher occurrences of stereotypes, aggression, and self-injurious behavior. Moreover, deficits in adaptive and expressive language skills are linked to challenging behaviors in people with autism spectrum disorder. However, research exploring the connection between gender and these behaviors, in individuals with autism, found no noteworthy differences between boys and girls (Gardner-Hoag et al., 2021).

The study objective to assess the varying levels of inattention and hyperactivity/impulsivity in children diagnosed with attention deficit hyperactivity disorder (ADHD), autism spectrum disorder (ASD), intellectual disability (ID), and the co-occurrence of ADHD/ID, ASD/ADHD, and ASD/ID, as these symptoms are commonly linked to these disorders.

The current research aimed to study the third-party punishment (TPP) performance of children with developmental problems above 9 years old in a natural environment, taking into account their nationality preferences (Manthorpe, 2001).

In this study, we examined how participants verbally punished players for violating the rules in football (soccer) and whether they were biased towards players of their own nationality. We then compared the view point of those with ASD to those with other developmental issues.

Further research is needed to investigate ADHD-related symptoms in neurodevelopment disorders such as ASD, ADHD, and ID, as they often have overlapping symptoms. The support for diagnosing ASD and ADHD together in the DSM-5 adds significance to this topic. Additionally, the impact of cognitive functioning on the level of inattention, hyperactivity, and impulsivity in individuals with ASD or ADHD has been understudied. Considering that many children with ASD and ADHD also have ID, it is crucial to explore this area of research. Clinicians need to accurately diagnose or identify co-occurring disorders, emphasizing the importance of understanding symptoms in children with ADHD, ASD, and/or ID.

In terms of technique, our strategy in this study differs from standard retribution research. The focus of conventional moral punishment research typically centers on laboratory activities that utilize the desire to penalize, such as the ruler game, challenge game, or Prisoner's Dilemma. The advantages of these systems are that they offer control and uniformity, but they suffer from drawbacks such as randomly chosen groups, artificial stimuli, and non-natural settings. Although moral punishment is intriguing scientifically, limited research is available beyond artificial contexts.

The structure of the paper is as follows: Section 2 reviews the literature related to the topic of the present proposal. Section 3 elaborates the details of the proposed model. In Section 4, several experimental results are presented. The proposed model is discussed in Section 5. Finally, Section 6 draws conclusions from the conducted research.

## 2. Related Work

These societal expectations or guidelines for conduct are occasionally broken. Anyone who disobeys a rule, a mandate, or crosses an established limit is considered a transgressor. When someone breaks a rule, people hold them accountable by exacting a penalty as retaliation for what they did (Silk, 2019). Humans have demonstrated a willingness to punish wrongdoers who violate social norms without personally harming them, or what is called a third-party punishment (TPP), even if doing so results in personal hardship. Altruistic punishment refers to this form of action, in which the person administering the punishment incurs costs while not directly benefiting from them (Elster, 2011). It is interesting to note that this pattern of punishing those who violate social, cooperative, or equitable distribution norms has been found to exist spanning a broad spectrum of cultural contexts (Henrich et al., 2010). According to some authors, penalty for the second party, which happens when the person who enforces the punishment on the violator has been personally injured by the violator, has diminished in effectiveness as societies have developed, because the members' capacity to connect with one another repeatedly has become less likely (Petersen et al., 2013).

The connection between anxiety, depression, ASD, and ADHD was studied by Morales-Hidalgo et al. (2023) to examine how it relates to children's clinical and cognitive abilities, as well as their parents' mental well-being. Children who have neurodevelopmental disorders (NDD) are more susceptible to emotional difficulties which increase and impact their daily lives as they grow older. Detecting these problems early and providing intervention can enhance the prognosis of NDD and address the emotional challenges they face. Albayrak et al. (2022) aimed to analyze the facial emotion recognition and social cognitive skill in children with ADHD and specific learning disorder (SLD). Additionally, the authors aimed to explore the potential relationship between literacy learning and emotion recognition. According to this research, individuals with specific LD and ADHD demonstrated weaker impact recognition abilities compared to their typically developing counterparts. Furthermore, the study indicated a correlation between the speed of literacy learning and the ability to recognize emotions. In relation to the shifts in neurodevelopmental disorders, Yang et al., (2022) assessed the occurrence of ASD, ADHD, LD, and ID in children and teenagers aged 3 to 17 years old in the United States during 2019 and 2020. The study discovered variations in the occurrence of ASD, ADHD, LD, and ID based on demographics, comorbidity/mental health issues, household/parental factors, and stressful life events. According to the article, children with developmental disabilities, especially ASD, faced emotional challenges during COVID-19. Online support was found to be ineffective for providing educational intervention to children with ASD in China (Zhao et al., 2023). In this study, the authors investigated

challenges faced by 50 children (aged 6 to 10 years old) diagnosed with ASD, ADHD, and DLD. In the research of Löytömäki et al., (2022), caregivers and experts observed that children with neurodevelopmental disorders faced various challenges in their social-emotional and behavioral domains, impacting their everyday functioning. Additionally, these children exhibited slower development in recognizing and understanding emotions compared to their typically developing peers.

Oftentimes, the penalty meted out by a third party is not entirely impartial. Particularly, when a member of a group (ingroup) violates a norm, the behavior is different as to when an outsider or a person from another group commits the violation; third parties (out group) behave differently. According to studies, punishment is frequently different even though moral norms are evaluated objectively. If a group member acts unfairly or uncooperatively within their own group, the punishment is more severe than if the same behavior were displayed by a third party. This situation is referred to as the “black sheep effect” (Verhofstadt et al., 2005; Shinada et al., 2004). However, TPP is typically greater when the violator belongs to a different cluster (Le, 2016; Schiller et al., 2014). Similarly, individuals tend to cooperate more readily within their own groups compared to others. Members of a group prefer to defend one another in social interaction situations, even when there is no clear personal advantage (Goette et al., 2006; Ramani, R. G., & Sivaselvi, K. 2017. *Autism Spectrum...* - Google Scholar, n.d.; Krupp et al., 2005). Parochial altruism was used to describe this difference in how people behaved toward individuals from their personal group and individuals from outside groups (Bernhard et al., 2006).

The probable brain circuits implicated in TPP have been outlined by neuroimaging research. When deciding whether to penalise someone who violates a social standard, the dorsolateral prefrontal cortex has been shown to become more active (Knoch et al., 2010; Knoch et al., 2006). However, when the transgressor is punished, the thalamus, nucleus accumbens, anterior cingulate cortex, insula, and caudate nucleus are all activated. According to Stallen et al., (2018), the satisfaction of punishing severely has been linked to amygdala activity, confirming the idea that the amygdala produces a spectrum of emotions depending on how much harm has been done or is to be done to the first party (Krueger & Hoffman, 2016).

According to the literature, two domain-general networks serve as the foundation for judicial judgments about third-party punishment: the middle administrative network to establish the suitable punishment, and the metalizing network to identify legal liability. In particular, the activity and connectivity of the prefrontal cortex in the dorsal horn, which receives information via way of the temporal lobe and is connected to the prefrontal cortex in the dorsal horn, were associated to the severity of the penalty. This is in line with the theory that the prefrontal cortex operates as the primary regulator of the activity pattern associated with third-party punishment, influencing the selection of the most suitable punishment (Bellucci et al., 2017).

Studies show that young people expect people to divide resources fairly, just as they do when they have to share their own, which is important for the development of their sense of fairness (Schmidt & Sommerville, 2011; Hamann et al., 2011). Up until around the age of 5 or 6, the need for justice is so strong that the child would rather forego using their own resources to ensure a fair sharing (Blake & McAuliffe, 2011; Shaw & Olson, 2012). Children do not begin to display partiality for members of their personal group until they are 8 years old (Buttelmann & Böhm, 2014; Jordan et al., 2014).

We are aware of only a few research papers that have investigated this paradigm in real-world contexts. One illustration is a study by Manthorpe (2001) to create a comprehensive system of inherent classifications based on the diverse spectrum of nationalities.

Sentiment Analysis by Google (Spanish version), supported by Natural Language API, was the utilized technique. Applications can adhere to a set of rules (code) and specifications known as an API, or “Application Programming Interface,” to communicate with one another. Similar to how a user

interface permits interaction between a computer and a human, the API serves as an interface for communication between several programs. Giving consumers access to a language interpreter may enable them to discover the intent behind a text, Google created the Cloud Natural Language API. To disclose the arrangement and meaning of natural language, machine learning is required. It can be applied to collect data about individuals, locations, and occasions in order to comprehend sentiment in popular culture tools such as public media. The earliest sentiment analysis studies were conducted during World War II to gather political viewpoints (Stagner, 1940). It is being employed to forecast disasters such as financial market collapses or terrorist incidents, to analyze consumer feedback on goods and services and to look at data from social networks (Gardner-Hoag et al., 2021;Hernandez-Suarez et al., 2018; Burnap et al., 2014). Recent studies employed this tool to analyse the patient's current behavior and predict future events that may affect their wellbeing, such as cardiological conditions (*Hemalatha, R., & Monicka, M. B. 2018.*) or mental illness, such fixation (Pollard et al., 2009;Corcoran et al., 2018).

Studies including juvenile populations with developmental problems and no natural scenarios have been found to utilize circumstances for both in- and out-groups.

### 3. Methodology

To carry out this research, numerous sample repetitions corresponding to a familiar theoretical model were required. In practice, we employed the Monte-Carlo method, generating computer-based data according to a predetermined theoretical model since the actual model remains unknown.

#### 3.1. Design

Analytical cross-sectional quasi-experimental investigation involving balancing samples.

#### 3.2. Population

Subjects had computerized medical records, including a cognitive examination between January and July 2018. The age range was from 9 to 17 years old. After the subjects were chosen, a neuro pediatrician verified the findings in accordance with the DSM-5 standards using the medical history, a neurological test, and a discussion with the parents. Those who had a valid diagnosis had a neuropsychological evaluation by a neuropsychologist.

39 Argentinean participants were enrolled, with two of them being excluded because they failed to complete all of the requisite neuropsychological testing. Thirty-seven participants were eventually included in the study.

#### 3.3. Exclusion Standards

Participants who had been diagnosed with epilepsy, schizophrenia, Tourette syndrome, CNS tumours, or abnormalities were excluded from the study.

Children with FSIQs below 50 were excluded from the study since they might have not been able to correctly understand the instructions given to them.

Patients with ASD who scored less than 80 on the VCI (Verbal Comprehension Index) or FSIQ (Full Scale Intelligence Quotient) were disqualified from the study.

Additionally, individuals who failed to pass all of the neuropsychological exams, did not have Argentine citizenship, and lacked knowledge of soccer (football) rules were excluded.

### 3.4. Resources and Procedures

The Spanish version of the Wechsler level, edition WISC V, includes the vocal fluency subtest from the developmental neuropsychological series evaluation of developmental neuropsychology, II edition, Spanish version (NEPSY II), as well as Sally-Anne hypothesis of intelligence test by Baron-Cohen were among the neuropsychological tests administered to the participants (Korkiakangas et al., 2016).

On the basis of the results of the IQ test, the following primary indexes were determined. A normal score of 100 and a 15-point normal deviation were used for the psychoanalysis of the WMI (Working Memory Index), FRI (Fluid Reasoning Index), PSI (Processing Speed Index), VCI (Verbal Comprehension Index), Full Scale Intelligence Quotient (FSIQ) and VSI (Visuospatial Index) (Na & Burns, 2016).

The phonological fluency and semantic fluency subtests made up the NEPSY II battery includes a vocal fluency test as part of its neuropsychological assessments. In the two 1-minute tasks that made up the phonological fluency sub-test, participants had to say as many words as they could that began both cases containing the letter “P,” and the other case including the letter “M”. The participants had one minute to name animals as part of the semantic fluency test and then, the names of foods and beverages for a further minute. These two exams were analyzed using scale scores, having a standard deviation (SD) of three, and an average of 10.

Two 40-second videos were viewed by the participants. During the 1986 World Cup match between Argentina and England, video 1 displayed the hand-assisted goal Maradona scored. Video 2 featured a goal scored by a Brazilian national team player using his hand during a 1995 Copa America encounter between Argentina and Brazil. The individuals watched the videos in a casual order; some watched video 1 first, followed by video 2, others in the opposite order. They were invited to share their views and thoughts about the events after seeing each video. The same questions were asked again after they had watched the second video. Each participant viewed the two videos, and their responses were contrasted in the two scenarios. After that, we compared the responses from the groups with ID (intellectual disability), learning difficulties, ASD, and attention deficit hyperactivity disorder (ADHD).

### 3.5. Analysis

Sentiment analysis, a type of artificial intelligence that combines computational techniques, using machine learning (ML), text analysis, and natural language processing (NLP), to extract and categorize favorable, negative, or unbiased opinions from the text, were used to analyze subjects’ responses (Hussein, 2018). In text mining, sentiment analysis software automatically categorizes text as positive or negative based on statistical and associational patterns, not linguistic analysis (Gardner-Hoag et al., 2021; Mäntylä et al., 2018). In this work, the total sentiment evaluation of each video was determined by taking into account the outcome at the paragraph level, even though the investigation was done in terms of both sentences and across the entirety of each paragraph. This outcome was continually rated using numbers 0 for neutral, + 1 for positive, and -1 for negative.

Age, FSIQ, Wechsler Scale primary score indexes, the vocal fluency subtest and emotional content of every video were evaluated as continuous variables. Sex, medical diagnoses, and testing Sally-Anne were the categorical variables.

A histogram and the Shapiro-Wilk test were used to evaluate the continuous variables' normal distribution.

In cases where the distribution was non-normal, the median value was supplied for continuous variables and in-between range. Otherwise, the average and the standard deviation were used. To communicate categorical variables, ratios or percentages were utilized.

The Wilcoxon signed-rank test was employed instead of the t test for paired samples when comparing normal continuous variables because the assumptions of normal distribution were violated.

If any cell's anticipated value was greater than or less than 5, respectively, we used either the Fisher's exact test or the Chi-square test for categorical variable analysis.

Wechsler scale indices, FSIQ and age were used as the self-regulating variables in a linear regression, with the total sentiment analysis as the dependent variable. The statistical software Stata 13.0 was used to conduct the analysis.  $P < 0.05$  was used to determine a statistical difference and Cohen's d measured the effect size.

Mean variations for paired samples, the sample size was estimated using the following parameters: a one-unit variations in effect size, an alpha value of 0.05, and a difference standard deviation of 2, and a power of 80% ( $\beta = 0.2$ ). 34 were chosen as the sample size, with a 15% anticipated data loss. The ultimate sample size was determined to be 39.

## 4. Results

39 Argentinean participants were considered, however two were excluded because they did not complete all of the requisite neuropsychological testing. In the end, the study included thirty-seven participants with an average FSIQ of 80.9 ( $SD \pm 16.2$ ) and an average age of 10.92 years ( $SD \pm 2.05$ ), including 28 men (76%).

The patients had all received medical diagnoses for autistic spectrum disorder (ASD), attention deficit hyperactivity disorder (ADHD), learning problems and intellectual disability (ID), see Table 1.

When it came to knowing the rules of football, every subject demonstrated their knowledge by stating unequivocally that, except for the goalkeeper, players cannot score goals with their hands or touch the ball with them.

*Table 1. Medical diagnoses are used to categorize population characteristics*

	ASD	LD	ADHD	ID
Subjects	8	7	12	10
Gender, male, n (%)	8 (100)	2 (49.00)	7 (60.54)	7 (88.89)
WMI, mean (CI 90%)	75.08 (62.14–88.03)	76.58 (63.19–89.98)	76.97 (72.76–81.18)	63.25 (60.64–65.85)
PSI, mean (CI 90%)	75.76 (60.65–90.88)	95.35 (89.8–100.89)	74.01 (72.21–75.82)	66.28 (60.71–71.85)
VCI, mean (CI 90%)	81.28 (61.28–101.29)	85.53 (72–99.06)	85.82 (83.75–87.88)	78.01 (70.35–85.67)
Age, mean (CI 90%)	11.54 (10.11–12.97)	10.8 (9.25–12.34)	12.11 (10.95–13.27)	10.16 (8.88–11.45)
FSIQ, Mean (CI 90%)	80.92 (62.77–99.06)	88.75 (81.66–95.84)	74.28 (68.71–79.85)	66.00 (60.88–71.11)

WMI = Working Memory Index, PSI = Processing Speed Index, VCI = Verbal Comprehension Index, FSIQ = Full Scale Intelligence Quotient



Initial comparisons were made between the findings of the overall sentiment analysis based on the statements expressed by subjects after seeing each of the videos. After viewing video 1, which showed the hand-assisted goal Maradona scored against England in the 1986 World Cup match, the disapproval was measured to be ( $M = -.13$ ;  $CI = 90\%.05$  to  $.3$ ). In contrast, video 2 featured a handling goal scored by a Brazilian national team member when Argentina and Uruguay played against each other. Brazil's performance in the 1995 Copa América (video 2) caused a negative sentiment ( $M = .39$ ;  $CI = 90\%.42$  to  $-.22$ ;  $t(32) = 4.97$ ,  $p < .0001$ ;  $d = 1.05$ ); a noticeable and unbiased difference exists between the two examples, resulting in a substantial effect size.

Except for the group of participants who have ASD, a notable distinction with a substantial effect size was discovered when the total results of the sentiment analysis for each video were afterwards assessed based on the diagnosis. In video 1, the ADHD group had a positive mean sentiment ( $M = .1$ ) with a 90% confidence interval of  $.10$  to  $.52$ , while in video 2, a negative feeling was displayed ( $M = .2$ ) with a 90% confidence interval of  $.46$  to  $.10$ ;  $t(10) = 2.94$ ,  $p = .005$ ;  $d = 1.12$ ). While the mean for video 2 received unfavorable feedback ( $M = -.30$ ;  $CI = 90\%.47$  to  $0.77$ ;  $t(4) = 1.87$ ,  $p = .04$ ;  $d = 1.33$ ), it was positive in the group with LD ( $M = .12$ ;  $CI = 90\% -.26$  to  $.56$ ), video 2 had a negative tone ( $M = -.32$ ;  $CI 90\% -.54$  to  $-0.86$ ;  $t(5) = 2.37$ ,  $p = .04$ ;  $d = 1.41$ ). A negative mean emotion was found after evaluating the group of respondents a diagnosis of ASD, as in the case of video 1 ( $M = -.1$ ;  $CI = 90\%.51$  to  $.31$ ); the same thing occurred in video 2 ( $M = -.41$ ;  $CI = 90\%.75$  to  $.08$ ;  $t(7) = 1.54$ ,  $p = .12$ ). While watching video 1, the mean sentiment in the ID group was positive ( $M = .20$ ;  $CI = 90\%.21$  to  $.65$ ), while watching video 2, it was negative ( $M = -.32$ ;  $CI = 90\% .57$  to  $.1$ ;  $t(7) = 3.11$ ,  $p = 0.01$ ;  $d = 1.3$ ) (Figure1).

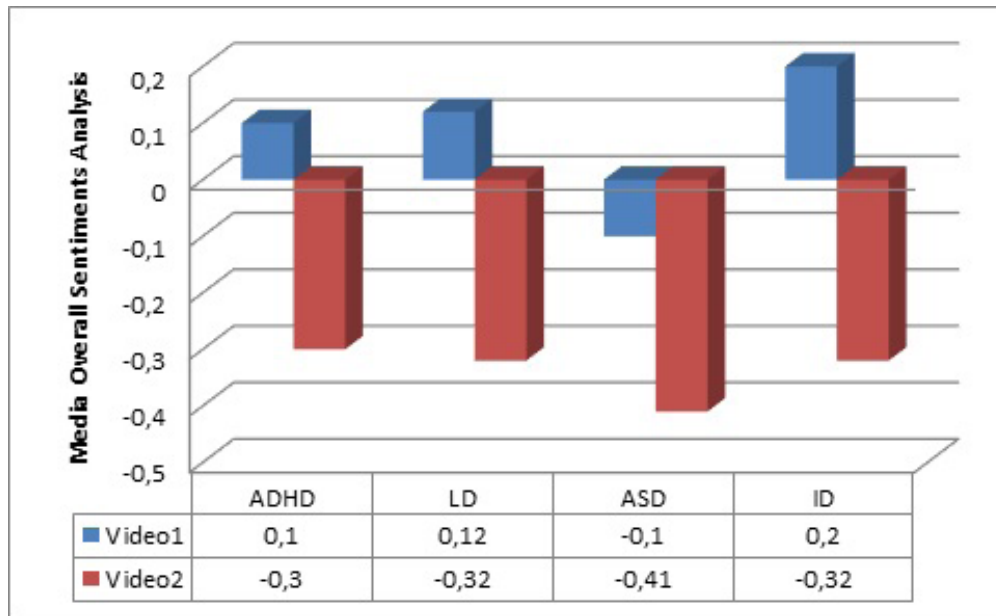


Figure 1. Average sentiment analysis scores were calculated based on video type and medical diagnoses, including ASD, ADHD, LD, and ID



WMI, FSIQ, age, PSI, and the expressed sentiments for each video were analyzed to see whether there was any correlation, but none of these variables showed a significant correlation (Table 2).

Table 2. WMI, age, FSIQ, and PSI relationships with overall sentiment analysis, broken down by type of video

	Video 1				Video 2			
	B (CI= 90%)	F (,)	r <sup>2</sup>	p	B (CI= 90%)	F (,)	r <sup>2</sup>	p
WMI	-.0006 (-.01 to .01)	1,35	.0006	.9	.001 (-.01 to .01)	1,34	.002	.8
PSI	.002 (-.01 to .01)	1,32	.004	.74	-.001 (-.01 to .005)	1,32	.008	.68
6FSIQ	.001 (-.0 to .01)	1,35	.002	.80	.004 (-.0 to .01)	1,34	.09	.08
Age	-.14 (-.08 to .07)	1,34	.002	.78	.026 (-.02 to .08)	1,35	.036	.24

Maradona's hand-assisted goal was seen in video 1 during the 1986 World Cup encounter between Argentina and England's national teams.

In the second video, a goal scored by a Brazilian national team member using his hand was shown during a Copa America match between Argentina and Brazil in 1995.

When performance was evaluated by sex, it was found that both males and females responded similarly; in both instances, an optimistic mood prevailed toward video 1, which was significantly different from the comments made regarding the extra video. Females displayed a median favorable response to video 1 (M = .35; 90% CI .02-.7) and with regard to video 2, the results were unfavorable (M = .4; 90% CI: .54 to .25; t (8) = 5.07, p < .0001). Similarly to females, males had good feelings towards video 1 (M = .06; 90% CI: .15 to .25) and unfavorable feelings towards video 2 (M = -.34; 90% CI -.47 to -.18, p < .0001).

To determine whether the sequence in which the videos were displayed affected the types of responses from the individuals, this order was examined. Nevertheless, in both cases, whether participants viewed video 1 first and video 2 second or in reverse, the median response was positive for video 1 and negative for video 2 (Table 3).

Table 3. Sentiment analysis according to the sequence in which the videos were viewed

	Video 1	Video 2	p
Video 1/Video 2 Subjects	15	15	.0002
Mean (CI 90%)	.1 (-.14 to .34)	-.45 (-.56 to -.32)	
Video 2/Video 1 Subjects	16	16	.004
Mean (CI 90%)	.14 (-.10 to .42)	-.21 (-.38 to -.06)	

\*Maradona's hand-assisted goal is shown in video 1; Argentina's and England's national teams competed in 1986, when the world cup took place.

\*In the second video, a goal scored by a Brazilian national team member using his hand was shown during a Copa América match between Argentina and Brazil in 1995.

51 % (CI 90% 24-76) of participants regarding the Sally-Anne test, which analyses mental speculation, correctly responded in the ADHD, 56% (CI 90 % 20-91) in the LD, and 53% (CI 90%20-82) in the ID groups, however, only 32% (CI 90% 7-65) of those with ASD correctly responded.

## 5. Discussion

Our study aimed to investigate TPP-type behavior in individuals with developmental disabilities, particularly young people with ASD, children aged nine and above, immersed in a natural environment, would experience a setting resembling intricate social scenarios where they make daily choices. Similarly, we looked at whether the behavior of children with ASD is comparable to that of children with ADHD, ID, LD, or comparable to that seen in lab investigations published up to date.

Similar to previously published research, we were able to discover that when punishing a transgressor in a natural situation, individuals also frequently exhibit an existing prejudice in favour of other members of their in-group (Schiller et al., 2014;Goette et al., 2006;Jordan et al., 2014; Halevy et al., 2012).When we compared verbal punishment studies to those studies, the findings of traditional moral punishment studies, which are frequently centered on lab tests and several games that were discussed in literature, such as the Prisoner’s Dilemma Task, Ultimatum Game, or Dictator Game, were also consistent.

An affinity for people in one’s own group was seen in our research, with the exception of the ASD group, even though everyone knew the rules and the transgressor were punished.

According to some scholars, a social competition incentive or moral anger against someone who deviates from the rules may be the causes of TPP-type behavior. According to speculation, social competition serves as the primary motive for punishment by a third party of those from one group who have not demonstrated cooperative behavior toward that group, whereas moral anger serves as the primary motivation for punishment of members of another group (Shinada et al., 2004)

According to some authors, both group and individual selection have an impact. Regarding individual selection, the hypothesis of kin selection is supported by the observed punishment pattern (Smith, 1964). According to this logic, third-party punishment meted out to members of their own group would be less severe than punishment meted out to members of a different group since the typical genetic link is stronger with members of their personal group and inferior with members of a different group. So, benefits may be achieved indirectly by favoring individuals, who broke the norm as a member, one discriminates against individuals who follow the same practices but are from a different group. It raises doubts about the kin selection hypothesis in today’s big social groups; the average genetic association is minimal. Maintaining a group’s reputation is the basis for the explanation of group selection (Bernhard et al., 2006). According to this theory, punishing individuals from other groups who harm our own group members can help create a reputation that discourages future violence against us. As a result, the safety of every member of their own group could be improved by severely penalizing “attackers” from other groups (Shinada, M. (2009). *Why Do Third Party Punish?: Second-or... - Google Scholar*, n.d.; Boyd et al., 2003). In summary, prejudice against criminals who are members of other groups and preferential treatment of those who commit crimes against them both have the potential to give the in-group an evolutionary advantage (Descioli & Kurzban, 2013).

It is intriguing to observe that our research found, individuals diagnosed with ASD showed no inclination towards individuals within their personal group. When making decisions in these situations, the significance of adhering to following guidelines took precedence above feelings for their personal group. Alternatively put, children with ASD appear to form their opinions on the basis of exact obedience to rules rather than on their membership in a group. This discovery is crucial because to the best of the authors’ knowledge, there are no comparable studies involving patients with this condition in the existing literature. We think that this situation is explicable by the role that sympathy plays especially when making decisions in people who are motivated by altruism. Since sympathy enables

ethical jury to comprehend pain and related considerations such as a social partner's desire to support or oppose a moral action, sympathy is a common sentiment that is crucial to the evolution of morality. The majority of studies on common executive in autistic people have found that they are less able to justify their decisions, have fewer contextual considerations, and have fewer emotional reactions to circumstances (Woodcock et al., 2020). Lately, some scholars have clarified how empathy modulation affects behavior involving third parties (Liu et al., 2018). In this sense, a greater degree of sympathy for individuals in their own group may account for favoring those individuals while discriminating towards members of competing groups, with whom one would have less empathy. In this regard, a greater level of sympathy for individuals in one's own group explains why some people favour those members and discriminate against individuals from groups that they have a lower level of sympathy for. As a result, participants with lower empathy levels, such as ASD sufferers typically adhere to the guidelines without favoring those in their personal group.

In social decision-making, executive function, theory of mind and emotion regulation serve crucial roles, according to recent studies (Woodcock et al., 2020). There is evidence that children with ASD experience difficulties with all three of them. The capacity to attribute others' mental processes, including intents and beliefs, is known as theory of mind (ToM), and it is vital for social interactions and romantic relationships. At the age of 3 or 4, typically developing children often pass the ToM test; in contrast, the majority of high-functioning ASD children continue to fail this task well into their teen years (Happé & Conway, 2016). In the neural circuits underlying ToM and related social cognition processes, young people with ASD exhibit abnormal neural activity that is related to their choices in financial games (Edmiston et al., 2014). Deficits in ToM thus play a significant part in autistic persons' inability to comprehend situations in social judgments. It could be another justification for why they value rules over the members of their own group when making decisions.

Children with ASD tend to obey rules and do not change their opinions depending on who they belong to in a group, which may be related to changes in executive functioning, particularly in cognitive flexibility. Although participants with ASD may be aware of social norms, when applying these standards to moral judgment, they seem to have less flexibility than children with normal development (Woodcock et al., 2020).

In our investigation, we were unable to link this behavior to sex, age, or intellectual ability.

It has been noticed that children over the age of eight exhibit behavior that is similar to that seen in studies on adult subjects, despite articles in the literature that have associated differing third-party punishment behavior according to age (Jordan et al., 2014). We think the conduct we observed was similar to adult behavior because our research involved pediatric patients who were 9 years of age or older.

Sentiment analysis, an artificial intelligence method, was used to quantify the sentiments and viewpoints expressed by the subjects. This is an important final point. The API for natural language, which was employed for sentiment analysis only separates positive and negative feelings, it does not pinpoint individual positive or negative feelings. Negative emotions include "angry" and "sad," for example. But when a text labeled as "angry" or "sad" is evaluated, the result just indicates that despite being harsh, the language is vague about its exact feeling. The study's findings, however, were comparable to those of others that had been published in the literature using other methods to examine third-party punishment behavior. In comparison we found that those studies did not provide promising results.

The videos used to test the construct proposed in our work have not been validated in other populations, which is a potential limitation of the study. Additionally, the entire ASD group was composed of men. However, we believe that our study offers information on the subject of third-party punishment



in pediatric groups, in both in-group and out-group settings, in a natural situation that is more akin to the intricacies of everyday life. Additionally, it has enabled us to build a better understanding of same actions in young people with developmental problems, particularly those diagnosed with ASD, so that we can develop therapies that are more suited to their requirements.

## 6. Conclusion

In our proposed method of analysis, the results show that except for those with ASD, subjects emotionally favoured members of their own group, as evidenced by their responses to video 1 and video 2. Children with ASD were more likely to follow the rules without favoritism for their members, suggesting they have lesser social cognition than other groups. Current ASD research focuses on early detection of socio-cognitive deficits in an effort to improve outcomes, therefore, we compared these parameters based on ASD group displayed negative emotions in both video 1 ( $M = -.1$ ; CI 90%  $-.41$  to  $.21$ ) and video 2 ( $t(7) = 1.54$ ,  $p = .12$ ;  $M = -.42$ ; CI 90%  $.76$  to  $-.08$ ) but the groups with ADHD, learning disabilities, and intellectual disability had a positive opinion of data in video1 but a negative one of data in video 2. Children with ASD tend to follow rules consistently, even when those breaking the rules are not part of their group. These findings are comparable to traditional moral punishment studies which frequently focus on lab testing. Our study examined the Prisoner's Dilemma Task, Ultimatum, and Dictator Game.

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