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Adolescents' Third-Party Punishment for Unfairness: Developmental Differences in Cognitive and Emotional Drivers

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Abstract: Third-party punishment (TPP) serves as a fundamental prosocial behavior essential for upholding societal fairness norms. This study recruited 104 participants, systematically divided into early (11–13 years), middle (15–17 years), and late (18–21 years) adolescent cohorts, to investigate the developmental characteristics of TPP. Furthermore, it explored the divergent associations of perceived unfairness and anger with TPP across these distinct adolescent subgroups. The results demonstrated that TPP intensity was significantly influenced solely by the level of unfairness, with no significant differences observed across the various adolescent developmental stages. Unfairness ratings were positively correlated with age and escalated alongside the unfairness level. Similarly, anger ratings were positively correlated with age, increased with the severity of unfairness, and exhibited significant developmental variations: early adolescents reported substantially lower anger ratings than their middle and late counterparts under unfair scenarios, whereas no significant difference emerged between middle and late adolescents. Correlation analyses revealed distinct subgroup patterns: the TPP of early adolescents was exclusively positively correlated with anger; late adolescents' TPP demonstrated a strong positive correlation with both perceived unfairness and anger; conversely, middle adolescents exhibited no significant correlations between TPP and either factor. Ultimately, this study indicates that TPP for unfairness remains developmentally stable throughout adolescence, and this consistent external punitive behavior is fundamentally underpinned by maturing internal cognitive-emotional mechanisms. These findings significantly deepen our understanding of adolescent TPP developmental mechanisms and provide robust empirical evidence for cultivating prosocial, norm-based behaviors.

Keywords: adolescence; third-party punishment; fairness; anger; prosocial behavior; cognitive development

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1. Introduction

Fairness is a foundational social norm that plays a critical role in fostering human cooperation and maintaining interpersonal order [1]. Third-party punishment, defined as the behavior of uninvolved individuals who willingly incur personal costs to penalize norm violators for unfair actions, is a significant prosocial behavior that supports the maintenance of fairness norms and facilitates large-scale social cooperation [2]. Research has consistently demonstrated that third-party punishment is a universal phenomenon observed across various age groups, including children, adolescents, and adults [3–6]. This universality underscores the developmental consistency of fairness norms as a core social preference throughout the human lifespan.

Adolescence represents a pivotal period for the development of social norm cognition and prosocial behaviors. During this stage, individuals experience rapid and

significant advancements in neural and psychological systems associated with emotional regulation, cognitive control, and social decision-making [7-10]. As a prominent form of prosocial behavior aimed at maintaining fairness norms, third-party punishment during adolescence has garnered increasing attention within the field of developmental social psychology. The theory of fairness preference suggests that humans possess an inherent aversion to inequity, positioning perceived unfairness as a potential cognitive precursor to third-party punishment [11-12]. Empirical findings have demonstrated a strong association between adolescents' evaluations of unfairness and the intensity of their punitive responses, highlighting the cognitive underpinnings of this behavior [13].

In addition to cognitive evaluations of unfairness, emotional factors, particularly anger, play a crucial role in motivating third-party punishment [1,14-16]. Studies have shown that anger significantly amplifies the severity of punitive actions, emphasizing its importance as an emotional driver of this behavior [17-18]. Furthermore, self-reported anger has been closely linked to third-party punishment across various developmental stages, including adolescence and adulthood. This evidence suggests that anger serves as a consistent emotional foundation for punitive responses to unfairness, reinforcing its role as a key motivator in upholding fairness norms [13,19].

Despite these insights, several important questions remain insufficiently addressed in existing research. First, adolescence is often treated as a homogeneous group, with limited differentiation among early, middle, and late adolescent stages. This approach obscures potential developmental differences in third-party punishment. Second, few studies have simultaneously examined the roles of perceived unfairness and anger in shaping adolescent punitive behaviors, making it challenging to disentangle the cognitive and emotional contributions to this phenomenon. To address these gaps, the present study investigates the developmental characteristics of third-party punishment across adolescent subgroups and explores the distinct roles of perceived unfairness and anger. This approach aims to provide a more comprehensive understanding of the developmental mechanisms underlying third-party punishment during adolescence.

2. Methods

2.1. Participants

A total of 104 adolescents were initially recruited for the study, encompassing three distinct developmental stages: early, middle, and late adolescence. Specifically, the sample included 37 early adolescents, 33 middle adolescents, and 34 late adolescents. However, data from participants who provided non-compliant responses were excluded to ensure the integrity and reliability of the findings. For instance, two early adolescents imposed punishment in scenarios deemed fair, which deviated from the expected behavioral norms. Additionally, one early adolescent and one middle adolescent imposed punishment levels that were excessively high in unfair scenarios, surpassing the proposer's allocated amount. After these exclusions, the final sample consisted of 34 early adolescents (13 females; ages ranging from 11 to 13 years, with a mean age of 12.5 years and a standard deviation of 0.6 years), 32 middle adolescents (12 females; ages ranging from 15 to 17 years, with a mean age of 16.4 years and a standard deviation of 0.7 years), and 34 late adolescents (8 females; ages ranging from 18 to 21 years, with a mean age of 19.9 years and a standard deviation of 0.7 years). Ethical approval for the study was granted by the Shaanxi Normal University Ethics Committee, ensuring adherence to established ethical guidelines and protocols for research involving human participants.

2.2. Procedure

The experiment utilized a within-subjects design, where each participant engaged in tasks under three distinct distribution scenarios: 25:25 proposals representing balanced fairness, 35:15 proposals reflecting moderate unfairness, and 45:5 proposals indicating significant unfairness. Before the main experiment commenced, participants were provided with standardized instructions in both oral and written formats. These instructions detailed the experimental tasks and response requirements without revealing

the research hypotheses. Participants were informed that they would interact with two unfamiliar players, referred to as Player A and Player B. Player A was responsible for deciding how to allocate 50 monetary units (MUs, with 1 MU equivalent to 1 yuan) between themselves and Player B. Player B's role was limited to accepting the proposed allocation. Participants, acting as neutral third parties, were given an initial endowment of 25 MUs. They were instructed that each MU they chose to invest would result in a 3 MU reduction in Player A's payoff, with the stipulation that Player A's final payoff could not fall below zero. Participants were required to determine the number of MUs they would allocate to penalize Player A. Subsequently, they were asked to evaluate the perceived fairness of the proposal and their emotional response, specifically anger, using 5-point Likert scales. The scales ranged from 1, indicating complete fairness or no anger, to 5, signifying high levels of perceived unfairness or intense anger.

2.3. Statistical Analyses

All statistical analyses were performed using SPSS software. Generalized Estimating Equations (GEEs) were utilized to investigate the main effects of adolescent developmental stage (early, middle, and late adolescence) and varying levels of unfairness (fair, moderately unfair, and highly unfair), as well as their interaction effects, on punishment intensity, unfairness ratings, and anger ratings. The adolescent developmental stage and unfairness level were treated as fixed factors, and the Wald χ^2 test was employed to evaluate the statistical significance of these effects. When significant main or interaction effects were identified, post-hoc pairwise comparisons with sequential Bonferroni correction were conducted to pinpoint specific group differences, ensuring the Type I error rate was controlled at $\alpha = 0.05$. This approach allowed for a rigorous examination of the data while minimizing the risk of false positives. The analysis framework was designed to provide a comprehensive understanding of how developmental stages and unfairness levels influence behavioral and emotional responses, ensuring robust and reliable conclusions.

Spearman correlation analyses were conducted to explore the relationships between age and the three core indicators: punishment intensity, unfairness ratings, and anger ratings. Additionally, correlations between punishment intensity and unfairness ratings or anger ratings were examined specifically under conditions involving unfair proposals. Separate Spearman correlation analyses were also performed within each adolescent developmental group to investigate these relationships at a more granular subgroup level. All correlation analyses were two-tailed, with statistical significance set at $p < 0.05$. This methodological approach ensured that the relationships between variables were thoroughly assessed, providing insights into how age and developmental stages influence perceptions and responses to unfairness. By analyzing these correlations within distinct developmental groups, the study aimed to uncover nuanced patterns that might otherwise be obscured in broader analyses, thereby contributing to a deeper understanding of adolescent behavioral and emotional dynamics.

3. Results

3.1. GEE Analysis

3.1.1. Punishment Intensity

The GEE analysis identified a significant main effect of unfairness level on punishment intensity (Wald $\chi^2 = 653.444$, $df = 2$, $p < 0.001$). However, no significant main effect of adolescent developmental stage was observed (Wald $\chi^2 = 2.177$, $df = 2$, $p = 0.337$). Additionally, the interaction effect between adolescent developmental stage and unfairness level was not statistically significant (Wald $\chi^2 = 2.342$, $df = 4$, $p = 0.673$). Post-hoc comparisons, adjusted using the sequential Bonferroni correction method, revealed that punishment intensity was notably higher for moderately unfair proposals compared to fair proposals ($p < 0.001$). Furthermore, punishment intensity increased further when comparing moderately unfair proposals to highly unfair proposals ($p < 0.001$). These findings suggest a clear gradation in punishment intensity corresponding to the level of

unfairness in the proposals. This pattern was consistent across all adolescent subgroups, as illustrated in Figure 1.

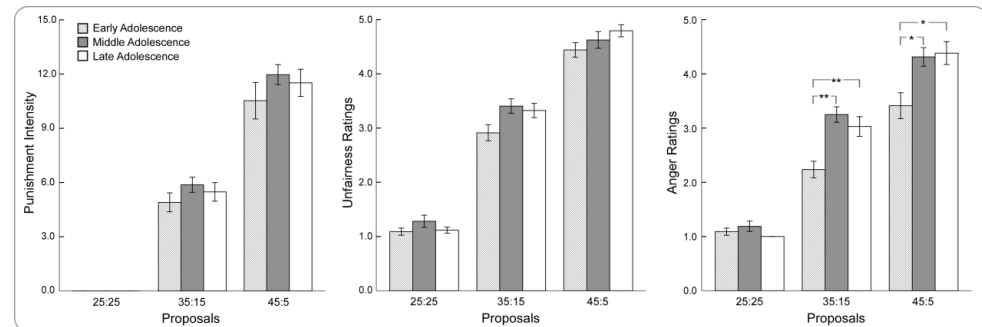


Figure 1. Punishment Intensity, Unfairness Ratings, and Anger Ratings in Response to Different Proposals for Each Adolescent Subgroup. *Indicates Adjusted $P < 0.05$, **Indicates Adjusted $P < 0.01$.

3.1.2. Unfairness Ratings

The GEE analysis revealed statistically significant main effects of both the adolescent developmental stage (Wald $\chi^2 = 6.596$, $df = 2$, $p = 0.037$) and the level of unfairness (Wald $\chi^2 = 1547.879$, $df = 2$, $p < 0.001$) on unfairness ratings. However, the interaction effect between these two variables did not reach statistical significance (Wald $\chi^2 = 7.816$, $df = 4$, $p = 0.099$). Post-hoc analysis indicated that there were no statistically significant differences in unfairness ratings among the various adolescent subgroups (all $ps > 0.05$). Ratings for moderately unfair proposals were notably higher than those for fair proposals ($p < 0.001$) and lower than those for highly unfair proposals ($p < 0.001$). This suggests a clear gradation in perceived unfairness based on the level of unfairness presented. Figure 1 visually illustrates these findings, providing a comparative overview of the ratings across different conditions. The results underscore the importance of considering both developmental stages and the degree of unfairness when evaluating perceptions of fairness, although the lack of interaction effects suggests these factors operate independently rather than synergistically. Such insights contribute to a deeper understanding of fairness perception during adolescence.

3.1.3. Anger Ratings

The GEE analysis on anger ratings demonstrated that the developmental stage of adolescents (Wald $\chi^2 = 19.539$, $df = 2$, $p < 0.001$) and the level of unfairness (Wald $\chi^2 = 546.735$, $df = 2$, $p < 0.001$) significantly influenced anger ratings. Additionally, the interaction between these two factors was also statistically significant (Wald $\chi^2 = 21.391$, $df = 4$, $p < 0.001$). Specifically, adolescents in the early developmental stage exhibited significantly lower anger ratings compared to those in the middle and late stages ($ps < 0.01$), while no notable difference was observed between the middle and late stages ($p = 0.471$). Furthermore, anger ratings showed a progressive increase as the level of unfairness intensified, transitioning from fair to moderately unfair ($p < 0.001$) and then to highly unfair proposals ($p < 0.001$). These findings underscore the nuanced relationship between developmental stages and sensitivity to fairness, suggesting that as adolescents mature, their emotional responses to perceived unfairness become more pronounced and consistent across varying levels of unfairness.

In examining the significant interaction effect, it was observed that for fair proposals, there were no notable differences in anger ratings among the three adolescent groups ($ps > 0.05$). However, for both moderately unfair and highly unfair proposals, early adolescents consistently reported significantly lower anger ratings compared to their middle and late adolescent counterparts ($ps < 0.05$). Notably, no significant differences were found between middle and late adolescents for either moderately unfair or highly unfair proposals ($ps > 0.05$). These results highlight the developmental progression in emotional responses to unfairness, with early adolescents showing a comparatively muted reaction to unfairness, while middle and late adolescents exhibit a more pronounced sensitivity to

such scenarios. This developmental trend may reflect the increasing cognitive and emotional sophistication that occurs as adolescents progress through different stages of maturity, enabling them to process and react to social fairness with greater intensity and complexity.

3.2. Correlation Analysis

3.2.1. Cross-Group Correlation Analyses

Spearman correlation analyses revealed several noteworthy relationships among the variables studied. Specifically, for unfair proposals, age did not exhibit a statistically significant correlation with punishment intensity, as indicated by a correlation coefficient of 0.070 and a p-value of 0.490. This suggests that age may not play a direct role in influencing the degree of punishment imposed in response to perceived unfairness. However, age was found to have a positive correlation with both unfairness ratings ($r = 0.222$, $p = 0.026$) and anger ratings ($r = 0.356$, $p < 0.001$). These findings imply that as individuals age, they may perceive unfair proposals as more unjust and experience stronger emotional reactions, such as anger, in response to such proposals. Furthermore, punishment intensity was positively correlated with both unfairness ratings ($r = 0.306$, $p = 0.002$) and anger ratings ($r = 0.365$, $p < 0.001$). This indicates that individuals who perceive proposals as more unfair or experience heightened anger are more likely to impose stronger punitive measures. These results collectively highlight the interconnected nature of emotional and cognitive evaluations in shaping behavioral responses to unfairness.

3.2.2. Group-Specific Correlation Analyses

Correlation analyses conducted within each adolescent subgroup revealed distinct and noteworthy patterns. For early adolescents, a statistically significant positive correlation was observed between punishment intensity and anger ratings, indicating that as the reported levels of anger increased, the severity of punishment also rose ($r = 0.383$, $p = 0.025$). However, no significant relationship was found between punishment intensity and unfairness ratings in this group ($r = 0.250$, $p = 0.155$), suggesting that the degree of punishment was not strongly influenced by perceptions of unfairness. In contrast, middle adolescents exhibited no significant correlations between punishment intensity and either anger ratings ($r = 0.142$, $p = 0.437$) or unfairness ratings ($r = 0.044$, $p = 0.812$), implying a potential developmental shift in emotional and cognitive responses to punitive measures. For late adolescents, the data revealed robust positive correlations between punishment intensity and both unfairness ratings ($r = 0.660$, $p < 0.001$) and anger ratings ($r = 0.615$, $p < 0.001$). This suggests that older adolescents may be more sensitive to punitive actions, perceiving them as both unfair and anger-inducing, particularly under conditions involving unfair proposals. These findings highlight developmental differences in emotional and cognitive processing across adolescence, as illustrated in Figure 2.

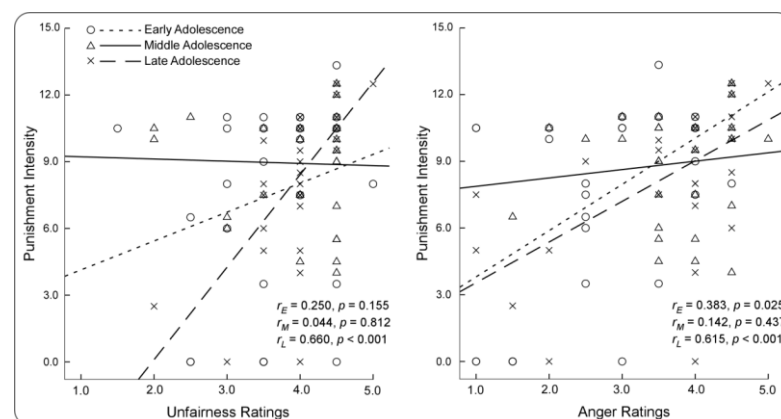


Figure 2. Correlations between Unfairness Ratings/Anger Ratings and Punishment Intensity under Unfair Proposals for Each Adolescent Subgroup.

4. Discussion

The present study aimed to explore the developmental characteristics of third-party punishment (TPP) in response to unfairness among early, middle, and late adolescents. The findings revealed that punishment intensity, unfairness ratings, and anger ratings increased consistently with the level of unfairness across all groups. However, developmental differences were observed only in anger ratings. Specifically, early adolescents reported significantly lower anger ratings compared to middle and late adolescents when faced with unfair proposals, while no significant differences were found between the middle and late adolescent groups. Correlation analyses further demonstrated that punishment intensity was positively associated with both unfairness and anger ratings overall. Interestingly, distinct patterns emerged across the developmental stages: in early adolescents, TPP was correlated solely with anger ratings; in late adolescents, TPP was correlated with both unfairness and anger ratings; and in middle adolescents, no significant correlations were identified. These findings underscore the nuanced developmental trajectory of emotional and cognitive responses to unfairness during adolescence, highlighting the evolving interplay between these factors in shaping fairness-related behaviors.

The stable intensity of TPP across adolescent stages, coupled with its gradual increase in response to higher levels of unfairness, aligns with prior research that identifies TPP as a consistent prosocial behavior throughout development [5,13]. This pattern mirrors findings from studies on children and adults, suggesting a universal human tendency to punish violations of fairness norms [4,6,20-24]. The absence of significant differences in TPP intensity across adolescent subgroups indicates that the motivation to uphold fairness norms through costly punishment is established early in adolescence and remains consistent throughout this developmental period. This supports the notion that adolescence represents a critical phase for reinforcing fundamental fairness-maintaining behaviors. The findings also suggest that while the outward expression of TPP behavior remains stable, the underlying mechanisms driving this behavior may differ across developmental stages, reflecting the complex interplay of cognitive and emotional factors that evolve during adolescence [10,25].

Although no significant differences in unfairness ratings were observed between adolescent subgroups, the positive correlation between age and unfairness ratings suggests an age-related improvement in social cognition and the ability to evaluate fairness [10,26]. This developmental trend highlights the increasing sophistication of fairness judgments as adolescents mature. In contrast, the lower anger ratings reported by early adolescents in response to unfair proposals may be attributed to their relatively limited capacity for empathy and emotional engagement in third-party contexts [8,19]. This distinction underscores the developmental divergence between cognitive and emotional responses to unfairness, with early adolescents relying more on basic emotional reactions and older adolescents demonstrating a more integrated approach that combines cognitive evaluation with emotional engagement. These findings contribute to a deeper understanding of the cognitive and emotional foundations of fairness maintenance during adolescence, emphasizing the importance of considering both dimensions in developmental research.

The overall positive correlation between TPP intensity and both unfairness and anger ratings reflects the interconnectedness of cognition, emotion, and behavior in the maintenance of fairness [27-28]. However, the group-specific correlations observed in this study provide valuable insights into the developmental progression of the internal mechanisms underlying TPP. During early adolescence, TPP appears to be primarily driven by emotional reactions, as evidenced by the exclusive correlation with anger ratings. By late adolescence, TPP integrates both cognitive judgments and emotional responses, indicating a more mature and balanced approach to fairness maintenance. Middle adolescence, on the other hand, represents a transitional phase in which the link between cognition, emotion, and behavior is still developing. This developmental trajectory suggests that while the outward expression of TPP behavior remains stable

across adolescence, the internal processes that drive this behavior undergo significant refinement [5,29]. These findings highlight the importance of examining the interplay between cognitive and emotional factors in understanding the development of fairness-related behaviors during adolescence.

5. Conclusion

This study demonstrates that third-party punishment (TPP) in response to unfairness remains broadly developmentally stable across early, middle, and late adolescence, while the intensity of TPP consistently increases as the level of unfairness becomes more severe in all subgroups. This pattern indicates that adolescents across these developmental stages are already capable of responding systematically to violations of fairness norms, even though the internal processes supporting such responses continue to evolve. At the same time, perceived unfairness and anger both show positive associations with age, suggesting that older adolescents may evaluate unfair situations with greater sensitivity and experience stronger affective reactions when confronted with inequitable treatment. Among these variables, only anger exhibits significant inter-subgroup differences for unfair proposals, highlighting the particular importance of emotional development in shaping age-related variation.

More importantly, the relationships among perceived unfairness, anger, and TPP differ across developmental subgroups. In early adolescence, TPP appears to be driven primarily by emotional responses, indicating that punitive behavior may be closely tied to immediate affective arousal. In late adolescence, TPP seems to reflect a more integrated process in which cognitive evaluation and emotional reaction jointly contribute to behavioral decisions. Middle adolescence appears to represent a transitional period between these two patterns, suggesting an ongoing reorganization of the mechanisms underlying fairness-related behavior. Taken together, these findings imply that the apparent behavioral stability of TPP across adolescence conceals meaningful developmental change in its cognitive-emotional foundations. Overall, the present results deepen understanding of how fairness maintenance develops during adolescence and offer important preliminary evidence that age-related maturation involves not only stable norm enforcement behavior, but also increasingly differentiated internal processes that support judgments, emotions, and punishment decisions in unfair social contexts.

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