

Social Reward Sensitivity and Moral Disinhibition: An Integrated Neurocognitive Model of Adolescent Risk-Taking Online and Offline

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Abstract. As peer pressure and online technologies make a change in the way adolescents value the benefits and the costs of risky behavior, risk-taking among adolescents has come to be an increasingly relevant interdisciplinary issue. Previous studies indicate that teens are more sensitive to detecting social evaluation and rewards than adults. However, the mechanisms by which peer presence and online anonymity have taken part influence the development of risky behaviors, neuroscientific, criminological, and cyberpsychology evidence, which this study analyzes the role of social contexts and digital worlds on the decision-making of teenagers. Research method based on the experiments by using driving-simulation activities, neurological investigations of ventral striatum, orbitofrontal cortex, and lateral prefrontal cortex, psychological models of disinhibition on the internet, and developmental studies of the intervention of bullying. This paper illustrates how peer presence enhances reward system activities, how anonymity online weaken empathic restraint, and how maturity shows up and moderates these influences in different age period. Evidence shows that adolescents become more likely to engage in risky actions in the presence of peers because of heightened stimulation of reward-processing and low cognitive control. Anonymity online gradually weakens moral regulation by reducing accountability and encouraging disinhibition, which leads to cyberbullying and other antisocial behavior. This study concludes that social reward sensitivity, digital invisibility impact, and immaturity during growth interact to influence the risky decision-making of adolescents. Moreover, prevention and intervention initiatives incorporating neuroscience, online self-control, and peer-based intervention are required to make healthy decisions in both online and offline worlds.

Keywords: Adolescent Risk-Taking, Peer Influence, Online Anonymity, Cyberbullying, Developmental Neuroscience

1. Introduction

Adolescent risky decision-making has become a critical interdisciplinary research topic in society due to the rapid changes in psychology, technology, and society. These transitions are gradually reshaping the mental and moral norms of decision-making among teens in both online and offline

environments. Adolescence is the transitional period between 10 and 19 years old when everyone experiences the rapid physical, cognitive, and social-emotional developments that connect childhood and adulthood. There is a broad scholarly consensus that the adolescent period is highly sensitive to rewards, immature cognitive control system, and is strongly motivated to acquire peer approval. Those characteristics drive teenagers to get trapped in dangerous actions to obtain different rewards, like confidence, satisfaction, or envy, which leads to cyberbullying or digital aggression. As the age grown, school has taken up the longest period of their life, the chance around with peers get higher, friends groups replace families gradually. The participation of peer presence and emerging with a new technology environment cause consequence of regulating emotions, shoulder moral responsibility, and assess the cost of actions.

According to existing research, adolescent risk-taking patterns is highly related to peer presence. As the behavioral experiments, “Chicken” driving simulation, illustrate that teens have a higher potential of making risky decisions than adults while peer presence [1]. fMRI as a neuroimaging way also confirmed this phenomenon. Ventral striatum, orbitofrontal cortex, and lateral prefrontal cortex which are the three regions that affect the brain work of decision-making process by assessing and projecting the potential benefits. As the result, penalties exhibit the highest level of activation when their peers are present, which led a higher potential of making risky decisions with peer environment [2]. These results demonstrate that personality or lack of self-discipline is not the only reason of impulsive behavior but is also influenced by part of neurodevelopmental mechanisms shaped by social environment.

With the viral dissemination of the internet, anonymity has already become a powerful factor, it both provides a high privacy requirement while also presenting an opportunity to disrupts moral self-regulation, reduce empathy, and foster aggressive behaviour online. The online disinhibition effect gives an explanation of why adolescents act differently between online and offline situations, which might show an extreme aggressive attitude, even cruelty, but would avoid such behavior offline [3]. Thus, cyberbullying is influenced by both the social incentives of peer acceptance and the reduced responsibility that is provided by internet anonymity.

This paper investigates how psychology, neuroscience, and criminology, as three study fields to affect the behaviors of adolescents, whether peer presence, online anonymity, and moral maturity of teens interact with each other to shape the risk-taking of adolescents. In the end, this study is expected to add a comprehensive approach to link up the offline and online environments, which can provide further understanding of the behavior of adolescents in a digitally connected world.

2. Peer presence and adolescent risk-taking mechanisms

During the process of adolescent growth, the presence of peers enhances the action of teens, which reflects an extreme heightened sensitivity of instant gratification to adolescents, at the situation of rewards higher than consequences causes them to make decisions in favor of risk and against conservative control, affects activity in the ventral striatum at the neural way, and their judgement and responsibility during the legally relevant decision making due to the presence of peers. An experiment named “Chicken” in order to test can teens make different decisions if the peers are watching or not, it analyzes adolescent risk-taking decisions by controlling a car in a computer game to choose whether you stop the car or not when the yellow light starts flashing. It also means there are risks of crashing the car where the wall in front of it and potentially losing all the points from their previous wins [1]. However, the data they collected showed that adolescents have a higher potential for risk-taking and make riskier decisions instead of adults with peers on their side during the task. Therefore, there are fewer peer-related changes in adults, so it is an age-related sensitivity

to show that there is an increasing trend of social reward reactivity. From a neurological perspective, it was found that, comparatively, there is increased risk-taking in adolescents with the presence of peers, but it was no more complicated than the fact that adolescents spend more time with peers than adults [2]. Three core regions of the cognitive control system of the brain show how they influence the function of adolescents. fMRI is used in this experiment, in order to detect ventral striatum (VS) and orbitofrontal cortex (OFC) from an incentive processing system, which influences the process of reaching a decision by evaluating and forecasting the possible rewards and punishments. Also, lateral prefrontal cortex (LPFC) of cognitive control system, it is facilitating use of goals to drive decisions; it monitors impulses and offers mental processes to deliberate on the alternatives. The data illustrate the changes in three different age groups (adolescents, young adults and adults) during the task. VS (0.35%) and OFC (0.2%) show the greatest activation among them with peer presence. In contrast, adolescents note a lower signal change by age, while adults have the highest at the same time by increasing activation [2]. From a criminological perspective, these context-social influences play a considerable role as the judgment and culpability of adolescence are inherently context-dependent, particularly influenced by social pressure. Fried and Reppucci note that young people have a unique tendency to be sensitive to peer pressure. The graph shows that youths in their mid-adolescence are less capable of developing a self-sufficient decision-making process and are more vulnerable to social influence [4]. They propose two potential explanations for susceptibility of adolescents to peer influence: younger teens will imitate immature adults, and middle-aged adolescents will temporarily show less maturity and use their peers to act in more mature ways before gaining self-control as adults.

3. Online anonymity, disinhibition, and cyberbullying

With the development of the internet, the range of target audiences is getting larger, especially among the younger generations. Also, online anonymity provides a simpler environment for the youths to make decisions without consequences, such as cyberbullying, which affects to build up a positive moral structure by weakening moral level, responsibility, and psychological cost of antisocial acts. Anonymity, characterized by the absence of cameras and eye contact, reduces social accountability and alters moral self-regulation. The research found that there are changes in reality that have a negative disinhibition and provide an online condition without eye-contact, which is how to make adolescents build up a common moral structure by shutting themselves down in their own world [3]. Psychologically, the online disinhibition effect is a phenomenon of people feel less pressure and express themselves more openly. However, this change might also switch to rude language, threats, anger, and hatred. Those changes are also creating a darker underworld of the internet, which is a place for crime, violence, even pornography, and it can be easily reached by adolescents [5]. In addition, cyberbullying is becoming common currently, especially in a condition where almost 70% of schools use the internet at school as a target for teens from 12-17 years old. Anonymity facilitates a disinhibitory mechanism by unique processes which kill empathy and guilt, allow hostile expression, which seems easy. People exhibiting callousness and an uncaring character are not very empathetic, guilt and remorseful, and mostly do not care about their personal crime or the welfare of other people. That is why such characteristics are typically associated with aggressive, bullying, and other antisocial types of behaviour [6].

Cyberbullying involves a sequence of psychological decisions in which peer presence increases perceived social rewards and anonymity decreases the cost and consequences of the bullying acts. In the presence of audiences, such as friend reactions and entertainment payoffs, adolescents incur distal costs, such as sanctions, reputation loss, empathic guilt, and underweigh [7]. Furthermore,

adolescents have a higher potential to engage in risky actions and behaviour than adults due to the influence of their similar peers. Generally, online anonymity and peer presence tend to act in a complementary manner, reinforcing effects of each other [8]. The aggressiveness propensity is increased in the presence of a peer, and the potential punishment is decreased in the presence of anonymity. And cyberbullying should be maximized when high-peer salience coincides with high-anonymity [9]. However, empirical studies examining the interaction of peer presence and anonymity remain limited, suggesting a need for future research in this area. Neurocognitive work is one of the most crucial perspectives to analyze adolescent risky choices with peer expectancy. fMRI results of risky decision-making and crashes number are evidence of showing adolescents make riskier choices when in peer presence than adults [2]. Only teenagers differed significantly, making more risky decisions in the presence of peers than alone, which could be seen through a larger number of decisions to GO [$t(13) = 2.16$, $p = .025$, one-tailed] and crashes [$t(13) = 4.06$, $p < .001$, one-tailed] to be experienced. In parallel, anonymity could minimize the cost of performing negative actions. Invisibility is the negation of existing stereotypes and prejudices regarding gender, age, skin complexion, physical appearance, stigmatizing actions, and physical and sensorial disabilities, negates visible social identities, contributing to deindividuation and reduced empathy in online interactions. Social presence decrease may trigger a process of de-individuation, which is brought about by communication, which can in turn lead to disinhibition [3].

4. Developmental factors and intervention strategies for adolescent risk and bullying

Adolescents, as individuals under the age of majority, are generally considered less mature than adults, which means they have a higher potential of being affected by various social content, such as social media or words from others. Iowa Gambling Test as the research method to test the decision-making of adolescents and adults, from 10 to 30 years old age range. The test result illustrates that avoidance behaviours rise linearly by age, which tells people with elder age avoiding disadvantages is more than for both preadolescents and adolescents. The scholars of the field of public health agree that the major threats to the state of mental and somatic well-being of adolescents cannot be ascribed to environmental influences but rather to risky habits within which young people willingly engage themselves such as substance use and reckless online activity [10]. The development of emotions and thought to peer pressure shows an increasing trend during early adolescence, have a notable peak at approximately 14 years old. Steinberg et al. indicate that throughout the various age ranges, the tendency to peer influence is linearly proportional over the age range of 14 to 18. However, evidence suggests that there is less developmental change in this capability between ages 10-14 and ages 18-30 [11]. The adolescent middle period is one of the crucial ones in the development of the ability to hold firm about what one believes, as well as resist pressurizing influences imposed by peers. In the digital age, Internet activities influence people by age as well. Empirical research found that there is a positive correlation between the age of the participants and their indulgence in Internet activities, with a negative correlation to the level of parental supervision [12]. Moreover, as access to technology increases and parental monitoring declines, adolescents face greater exposure to unregulated online interactions. Also, bullying is getting less, and the environment of school should be lessened as participants become adults. It notes that mostly maturity can be shown in people by age, and parental guardianship or school monitoring decreases, leading to a change of adolescents being influenced more by peers.

As peer presence increasingly shapes adolescents' decision-making, partly due to their heightened sensitivity to social evaluation, prevention and intervention efforts should be initiated promptly. In the past decade, school bullying has drawn increasing scholarly attention, largely because of its

rising prevalence and documented long-term harm on adolescents' mental health. Adolescence is a marked developmental stage in which peer influence becomes especially salient, partly because youths are forming social identities and seeking group acceptance [13]. School-based prevention and intervention are particularly effective because structured peer environments allow continuous monitoring and timely support for both bullies and victims. First, age is a decisive factor because developmental differences across 7–15 years substantially shape how adolescents respond to anti-bullying programs. Results of two tests by Ttofi and Farrington and Jiménez-Barbero are quite different, Ttofi and Farrington found that students older than 11 benefited more from interventions, possibly due to their more advanced cognitive skills and ability to reflect on social behavior, older students who are greater than 11 years old are better affected than younger [14]. However, Jiménez-Barbero et al. argued that focusing solely on age is insufficient, suggesting that factors such as school climate, program design, and peer dynamics may also shape intervention outcomes, which means the only variable being age is inaccurate, the findings by them are completely opposite from the previous research results, which is the prevention and intervention have greater impact on under 10 years old kids [15]. Therefore, Salmivalli, C et al. propose examining self-efficacy as a moderator because it reveals how confidence in managing social conflicts influences intervention responsiveness. This meta-analysis provides a more precise and accurate process of the research and results [13-15].

5. Conclusion

This study has analyzed risky actions by adolescents by combined peer influence, internet anonymity, and self-maturity development level together to examine. Based on behavioral, neurological, and psychological evidence, a trend had been shaped, which teenager has a higher sensitivity than adults to immediate social rewards, and easier influenced by judgement from fellow adolescents, especially in an environment where there is a weak sense of empathy and responsibility. These processes work in both reality and the digital environment; peer observation makes reward systems more active offline, and anonymity reduces the perceived consequences and promotes moral disengagement online. Combined, these factors give reason why adolescents are overrepresented in risky behavior like showing aggression, cyberbullying, and spontaneous decision-making.

There are three key conclusions that can be summarized from the findings in this paper. First, peer presence increases higher chance to enhance risk-taking by making them more sensitive to rewards and less cognitive controls, which is shown in behavioral tasks and in fMRI studies. Second, the anonymity that adolescents have online promotes the loss of will power, lack of inhibition, and moral self-control, which provides adolescents a sense of poor consequences required after taking harmful actions without emotions or social outcomes in all ways. Third, these influences are moderated by several developmental factors, including age, emotional maturity, and cognitive development, and shape the responses of youth to peer influences and online space. Specifically, 14 to 18 years old as a special period becomes a highly vulnerable age group while converging peer relationship, neural development, and internet exposure.

These findings provide several pivotal implications. Prevention and intervention have considered satisfying both peer environments and digital structures in shaping behavior to achieve a better moral standard. School-based programs should also take developmental differences into consideration due to the different responses from ages. Improving online safety needs technology regulation and cultivate a sense of empathy, social accountability, and self-efficacy as part of peer networks in digital space.

Ultimately, the importance of this study lies in the interdisciplinary method of research is cross-sectoral, by combines neuroscience, psychology, and criminology, this paper gives a thorough explanation of the reasons why adolescents take risks both online and offline. It emphasizes that wrong decision-making by adolescents have no relation to individual moral failure, whereas a result of reshaping by the process of development of society and technology. These mechanisms play a crucial role in order to implementing more efficient education, better mental development, and policy interventions, while guarantee teens have the essential support and guidance that they need to get through the world with peer pressure or online interruption increasingly defining their social reality.

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