

Perceived Parental Control and Risk-Taking from a Machine Learning Approach

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The European Conference on Psychology & the Behavioral Sciences 2018
Official Conference Proceedings

Abstract

The purpose of the current study was to examine the relationship of parental control and risk-taking among emerging adults. Specifically, the study examined the differences between high risk-taking and normal college students in parental control, risk-taking, and risky decision-making. Data were drawn from 538 college students by using an online survey. The measurements included demographic questions, parental control, risk tolerance, risk self-schema, and risk-taking. Two unsupervised learning methods, including data cloud geometry tree (DCG-tree) and agglomerative hierarchical clustering tree (HC-tree), were used to get clusters of participants based on the pattern of their responses on risky decision-making. Next, post hoc tests were conducted to examine the differences between the potential high risk-taking group and normal group. Among the participants, 22 students showed a special pattern in their responses and clustered into a group as potential high risk-takers. Compared to the normal group, the potential high risk-takers were more likely to engage in risk-taking behaviors (e.g., risky driving, smoking) and reported lower parental behavioral control and higher psychological control. In addition, the Wilcoxon rank-sum tests indicated that the high risk-takers could tolerate more risks and were more likely to have a self-schema of being a risk-taker in the decision-making process. The study suggests that parental control plays an important role in risk-taking among emerging adults. In addition, using machine learning approach can help identify the potential high risk-takers, who show distinctive characteristics that are different from the normal emerging adults and can be included as target in future intervention programs.

Keywords: parental control, risk-taking, machine learning

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Introduction

Risk-taking refers to behaviors that are associated with a chance of undesirable results (Boyer, 2006). Youth are typically perceived as risk takers because they often exercise poor decision-making that favors short-term gains (Spear, 2002; Steinberg, 2004). Numerous studies have provided evidence that parental control plays an important role in youth's risk-taking; however, there are limitations in the literature. First, the majority of studies have examined behavioral control, and only few attempts have been made to explore how psychological control influences risk-taking. Second, most of the research on parental control has been conducted with children and adolescents, but the study among emerging adults is also necessary as recent research has indicated that parents continue to exert control over their college-aged children. Thus, the purpose of the current study was to examine the relationship of parental control and risk-taking among emerging adults by using the machine learning approach. The study further examined the differences between high risk-taking and normal emerging adults in parental control, risk-taking, and risky decision-making.

Parental Control

Barber, Olsen, and Shagle (1994) clarified that there are two forms of parental control with conceptual distinctions. *Behavioral control* refers to regulation of behavior and activities without negating youth's own thoughts or ideas. *Psychological control*, on the other hand, is defined as parents' attempts to shape children's behaviors via tactics such as constraining verbal expressions, invalidating feelings, personal attack, and love withdrawal.

Parental behavioral control and psychological control have been linked to a variety of youth's developmental outcomes. Generally, parental use of behavioral control can promote positive behavioral outcomes in children (e.g., Barber, 1996; Fletcher, Steinberg, & Sellers, 1999; Kincaid, Jones, Cuellar, & Gonzalez, 2011) because parents who use behavioral control provide rules and restrictions, which monitors and regulates children's behavioral worlds. For example, several studies have found that parental behavioral control has protective effects on children's externalizing problems, such as drug use (Martins, Storr, Alexandre, & Chilcoat, 2008), cigarette smoking (Guo, Reeder, McGee, & Darling, 2011), and alcohol use (Arria et al., 2008). Children have been consistently found to be more likely to have positive behavioral outcomes if they perceive a high level of behavioral control from their parents.

In contrast, parental psychological control is associated with children's negative outcomes, such as internalizing problems (e.g., Barber, 1996; Kincaid et al., 2011) because parents who utilize psychological control may manipulate children's thoughts and feelings, which then inhibits children's development of autonomy and independence. For instance, empirical evidence has shown that parental psychological control is linked to depressive symptoms (Loukas, 2009) and low self-esteem (Bean & Northrup, 2009). However, in terms of risk-taking behavior, the relation is unclear given that the link between psychological control and risk-taking has mixed results in the literature. Therefore, the current study aimed to examine the relationship of the two forms of parental control and risk-taking in order to better understand how parental control may influence youth's risk-taking.

Risky Decision-Making

Decision-making refers to cognitive process of making choices among competing courses of actions (Raiffa, 1968). When making a decision regarding risk-taking, one considers potential gains and losses in the decision-making process, such as perceived vulnerability (Urberg & Robbins, 1984) and risk perception (Beyth-Marom, Austin, Fischhoff, Palmgren, & Jacobs-Quadrel, 1993). To examine the characteristics of risk-taking among youth, the present study focused on two domains of risky decision-making: risk tolerance and risk self-schema.

Risk tolerance is defined as the maximum amount of risk that someone is willing to accept (Grable, 2000). It depends on the evaluation of the risk, such as the threat of loss or the opportunity for gain (Lopes, 1987). Research on risk tolerance has found that when individuals are in the pursuit of some goals, they may be more willing to accept the risks in order to achieve their goals, and their willingness to accept risk is positively correlated with their actual behavior (Corter & Chen, 2006).

Risk self-schema refers to cognitive generalizations about the self as someone who takes risks. When risk self-schema is activated, the beliefs about the self as a risk taker are activated and will facilitate performance of risk-taking behavior. Research has suggested that self-concept plays an important role in one's engagement in health-related behavior (Freeman, Hennessy, & Marzullo, 2001). When individuals consider themselves risk-takers, the projected behaviors, such as drug use and smoking, may be reinforced and rationalized. In this manner, we focused on risk tolerance and risk self-schema in the decision-making process to examine risk-taking.

Machine Learning Approach

The present study aimed to identify the high risk-taking emerging adults and compare them with the normal group regarding their perceived parental control, decision-making, and risk-taking. To identify these emerging adults from the sample, the machine learning approach was applied. Computational social science has been discussed extensively recently, and using machine learning techniques helps researchers to look at data from a different perspective. Machine learning is a data-driven approach by using statistical techniques and algorithms to explore a dataset and discover the hidden information. By quantifying the association of the observations, we can find the structure of a dataset. Unsupervised learning is a technique in machine learning that groups observations by their association so that observations in the same cluster are more similar than those in other clusters. With clustering results, researchers can explore the clusters and understand the characteristic of each cluster.

In this study, two unsupervised learning methods were performed to group the emerging adults based on their risk tolerance. The two tree-based clustering methods, including data cloud geometry tree (DCG-tree; Fushing, Wang, VanderWaal, McCowan, & Koehl, 2013) and agglomerative hierarchical clustering tree (HC-tree), were compared to make sure the stability of clustering results. The cluster that contained special behavior patterns would be considered potential high risk-taking group.

The Current Study

The purpose of the present study was to examine the relationship of parental control and risk-taking among emerging adults. Specifically, we used unsupervised learning method to identify the high risk-taking college students, and compared them with normal emerging adults in perceived parental control, risky decision-making, and risk-taking.

Given that parental behavioral control is considered positive whereas psychological control is considered negative in terms of their influences on children's behavioral outcomes, we hypothesized that high risk-taking emerging adults would perceive a lower level of behavioral control and a higher level of psychological control, compared to the normal emerging adults. In addition, high risk-taking group was predicted to tolerate more risks, be more likely to perceive themselves as risk-takers (i.e., risk self-schema), and engage in risk-taking more frequently, compared to the normal group.

Methods

Participants

A total of 538 (176 males, 362 females) college students in the U.S. ($N = 382$; age $M = 18.53$, $SD = .53$) and Taiwan ($N = 156$; age $M = 18.94$, $SD = .62$) participated in an online survey. Participants in the U.S. were ethnically diverse (42.9% Asian American, 33.5% Hispanic, 12.8% Caucasian, 3.9% Black or African American, 2.6% Middle Eastern, and 4.3% Other/Mixed), while participants in Taiwan were all of Taiwanese descent. The U.S. students fulfilled a course requirement by participating in the study, whereas the Taiwanese students received a gift card as compensation for participation. The study was reviewed and approved by the university's Institutional Review Board.

Measures

Psychological Control. Psychological control was assessed by the 10-item Psychological Control Scale (Barber, 1996), the 8-item Psychological Control-Disrespect Scale (Barber, Xia, Olsen, McNeely, & Bose, 2012), and one item for shame (Chou & Chou, in press), including the following sub-domains: constraining verbal expression, invalidating feeling, personal attack, love withdrawal, guilt induction, disrespect, and shame. Participants were asked to rate how well the items described their mother and father (or non-biological parents) separately (0 = *not like her/him* to 3 = *a lot like her/him*), such as "My Mother is a person who brings up my past mistakes when she criticizes me". Higher scores indicated greater perceived levels of psychological control. The Cronbach's alphas were .906 for maternal control and .921 for paternal control.

Behavioral Control. Behavioral control was measured by the 9-item Behavioral Control Scale (Barber et al., 1994). Participants rated on a 3-point scale how well the items described their parents (1 = *not like her/him* to 3 = *a lot like her/him*). Sample item is "My mother lets me do anything I like to do." The Cronbach's alphas were .694 and .753 for maternal control and paternal control, respectively.

Risk Tolerance. An 8-item Risk Tolerance Scale was used to assess the amount of risk in percentage that one is willing to accept given different situations. Different situations include situations concerning self (e.g., getting injured or hurt, and losing one's money) and situations concerning others (e.g., hurting other people, and disappointing one's family). Participants were instructed to answer the questions on a scale from 0% to 100% chance of risk, where 0% indicated no tolerance of risk and 100% indicated the maximum tolerance of risk. The scale indicated good reliability (Cronbach's alpha = .841).

Risk Self-Schema. The 8-item Risk Self-Schema measure developed by the author and colleagues was used to assess the degree that one views the self as a risk-taker. Participants rated on a 5-point scale (0 = *Not me at all* to 4 = *That's me!*) how much they view themselves as a risk-taker in terms of specific risk activities, such as risky driving and binge drinking. Cronbach's alpha coefficient of internal consistency was .739.

Risk-Taking Behavior. The revised Risk Involvement and Perception Scale (Parsons, Siegel, & Cousins, 1997) was used to assess participants' self-reported risk-taking behaviors. Participants were asked to choose a number that corresponded to their involvement in each of the 18 behaviors during the past 3 months. The 18 behaviors constitute a representative set of risk-taking behaviors, such as riding with a drunk driver, using marijuana, and having sex without a condom. Participants rated on a 9-point scale, from 1 = *never* to 9 = *daily*. For the interest of the current study, only items for risky driving, binge drinking, marijuana use, smoking, and unprotected sex were used. The Cronbach's alpha for these selected items was .626.

Data Analytic Strategy

To identify the potential high risk-takers, the study applied the machine learning techniques. Two unsupervised learning methods, including DCG-tree and HC-tree, were used to get clusters of participants based on the pattern of their responses on risk tolerance. The heatmaps were constructed to show the mean response patterns of each group. Next, the Wilcoxon rank-sum tests were conducted to examine the differences between the potential high risk-taking group and normal group. The data analytic process can be found in Figure 1.

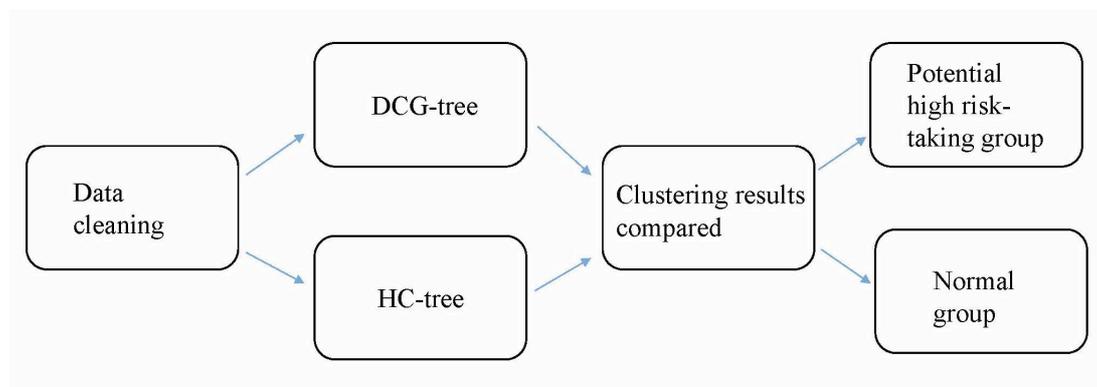


Figure 1: Flow chart of data analytic process.

Results

Among the participants, 22 students showed a special pattern in both DCG-tree and HC-tree and clustered into a group as potential high risk-takers. The responses of behavioral control and each psychological control component for the two groups are shown in Figures 2 and 3, respectively. Risk tolerance and risk self-schema are shown in Figures 4 and 5, respectively.

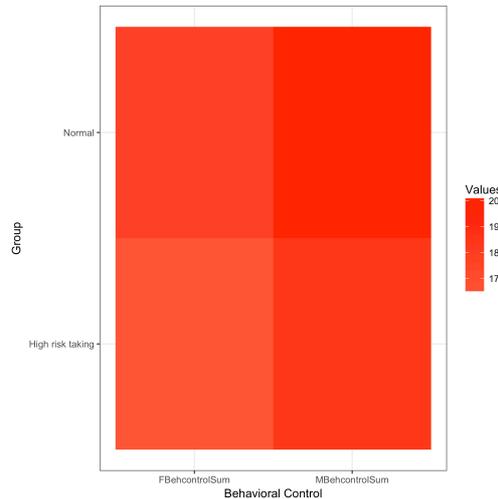


Figure 2: Comparison of high risk-taking group and normal group on behavioral control.

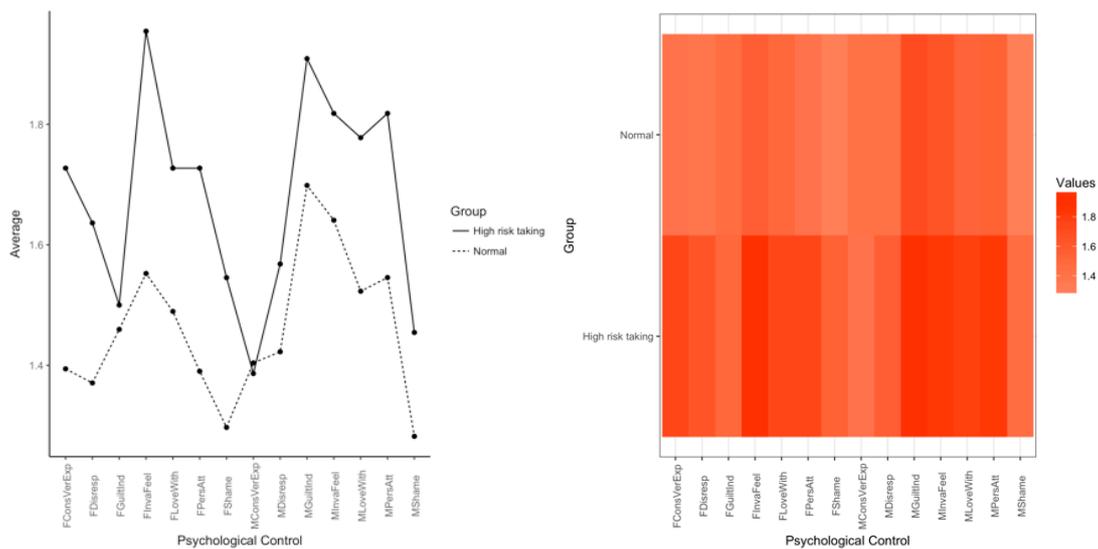


Figure 3: Comparison of high risk-taking group and normal group on psychological control.

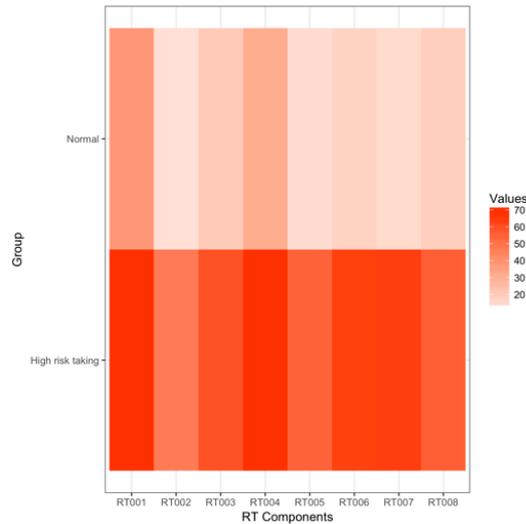


Figure 4: Comparison of high risk-taking group and normal group on risk tolerance.

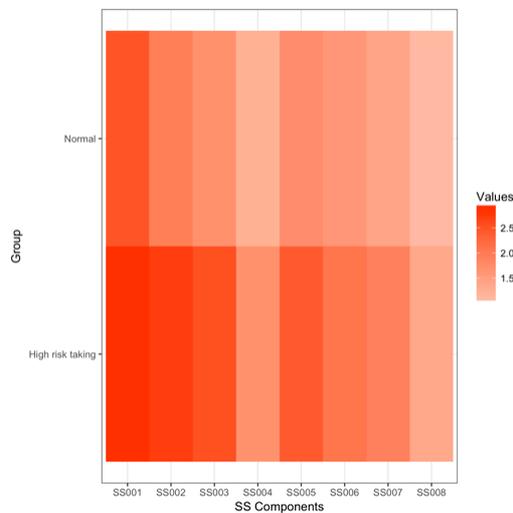


Figure 5: Comparison of high risk-taking group and normal group on risk self-schema.

Next, Wilcoxon rank-sum tests were performed to compare the difference of distributions of the two unbalanced groups. The normal emerging adults perceived a higher level of maternal behavioral control ($W = 3898.5$, $p = 0.015$) and paternal behavioral control ($W = 4050.5$, $p = 0.098$) than the high risk-taking emerging adults. In terms of parental psychological control, generally, the high risk-taking group perceived a higher level of psychological control than the normal group. The two groups were significantly different in maternal personal attack ($W = 7209$, $p = 0.023$), maternal love withdrawal ($W = 6794.5$, $p = 0.039$), maternal disrespect ($W = 7004.5$, $p = 0.048$), paternal invaliding feeling ($W = 6906$, $p = 0.017$), paternal personal attack ($W = 6838$, $p = 0.026$), paternal disrespect ($W = 7181$, $p = 0.010$), and paternal shaming ($W = 6625$, $p = 0.020$).

Moreover, the two groups showed significant differences in the risk tolerance items (all p values < 0.0001) and general risk self-schema ($W = 8355$, $p < 0.001$), suggesting that high risk-takers could tolerate more risks and were more likely to have a self-schema of being a risk-taker in the decision-making process, compared to their counterparts. In addition, compared to the normal group, the potential high risk-taking group was more likely to engage in risk-taking behaviors ($W = 7083$, $p = 0.019$).

Discussion

The current study aimed to examine the relationship of parental control and risk-taking among emerging adults. In order to identify the high risk-taking emerging adults and compared them with the normal emerging adults, we used machine learning techniques, including DCG-tree and HC-tree, to get clusters of participants based on their risk tolerance. Several important findings emerged and supported the hypotheses.

First, the high risk-taking group perceived a lower level of parental behavioral control than the normal group. The results are consistent with the literature, such that behavioral control is perceived as positive that promotes children's better behavioral outcomes (Fletcher et al., 1999; Kincaid et al., 2011). Our results indicated that parental use of behavioral control has protective effects on college students' risk-taking; parents monitor and regulate their children's activities and behaviors, which leads to children engaging in risk-taking behaviors less frequently.

On the other hand, the results showed that the high risk-taking emerging adults perceived a higher level of parental psychological control than the normal group, which is in line with the prior findings that psychological control is regarded as negative that intrudes on children's psychological worlds (Barber, 1996; Kincaid et al., 2011). It is possible that the perception of psychological control from parents makes college students feel a threat to their senses of autonomy, which may result in rebelliousness and risk-taking behavior during the transition into emerging adulthood. Therefore, our findings suggested that parental use of psychological control may be negative and increase college students' likelihood of risk-taking.

Next, the high risk-taking group was found to tolerate more risks, compared to the normal group. That is, the high risk-taking participants were more likely than their counterparts to tolerate the risks of getting hurt, hurting other people, losing money, and disappointing family if they really wanted to do something. Consistent with the prior studies, our results indicated that when high risk-taking individuals were in the pursuit of some goals, they were more willing to accept the risks, and were more likely to engage in risk-taking behaviors. In terms of risk self-schema, high risk-taking emerging adults were more likely to perceive themselves as risk-takers than the normal emerging adults. These individuals held the beliefs about the self as someone who takes risks. Their beliefs can shape and rationalize their behaviors, and contribute to their engagement in risk-taking behaviors (Freeman et al., 2001). Consequently, it is important to look at the cognitive process when examining risk-taking in emerging adulthood.

It is noteworthy that the current research examined both maternal and paternal control. Inclusion of fathers in parenting studies is necessary but lacking in the literature. Our results showed that the high risk-taking group perceived high levels of both maternal and paternal psychological control and low levels of both maternal and paternal behavioral control. The similar findings of mothers and fathers indicated that both parents are important social agents in shaping children's behavior. Additionally, the present study suggested that parental control has an influence on not only children and adolescents but also emerging adults. Parents continue to exert control after their

children get into college, and may further influence their children's risk-taking behaviors.

Moreover, the present study suggested that using the machine learning approach can help identify the potential high risk-takers. There are plenty of unsupervised learning methods in the machine learning field, and the current study used two tree-based clustering methods (i.e., DCG-tree and HC-tree) to get clusters of the participants. Using tree-based clustering methods helps visualize how the paired observations merge into clusters, which makes it easier to identify the relationship of the observations graphically. Although there is not a standard way to quantify the performance of the clustering results, the present study indicated that using the tree-based clustering methods can identify the potential high risk-takers among emerging adults and may be helpful in future intervention.

Limitations and Future Directions

The present study had a few limitations. First, we used self-reports from college students. Future research could include parents' reports of parental control from both mother and father to avoid bias. Second, we used cross-sectional design in our study. A longitudinal design in the future will help to capture the changes in parental control and its associations with behavioral outcomes from adolescence to emerging adulthood.

Although more research is needed, future intervention programs may be targeted to the potential high risk-takers, involve not only students but also their parents in the programs, and focus on parent-child relationship. Also, the programs can provide practices in decision-making skills to help emerging adults to build their decision-making competencies (McCoy, Chou, & Guerra, 2016). The broader impact of the current study is to prevent college students from engaging in risk-taking behaviors and to promote their positive development.

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