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Longitudinal and reciprocal relations between delay discounting and crime

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Abstract

Theorists argue that self-control failure is the underlying cause of criminal behavior, with previous research linking poor self-control to delinquency and drug use. The path from self-control to crime is well-established, but less is known about whether criminal behavior contributes to self-control deficits over time. We investigated bi-directional relations between self-control assessed via a delay discounting task and self-reported crime over a three-year period. During their first, second (73.38% retention rate), and third (63.12% retention rate) years of college, 526 undergraduates completed a delay discounting task and reported on their criminal behavior. In order to maximize variability, participants with conduct problems were overrecruited, comprising 23.1% of the final sample. As expected, more discounting of hypothetical monetary rewards significantly predicted future property crime across a one and two-year period, even when controlling for initial levels of both. This study also demonstrated evidence of a bi-directional relationship; violent crime predicted higher rates of delay discounting one year later. These results suggest that bi-directional relations exist between self-control and types of crime.

Keywords

delay discounting; crime; property crime; violent crime; college students

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The seminal book *A General Theory of Crime* (Gottfredson & Hirschi, 1990) argues that poor self-control is an underlying cause of crime. This theory has held up empirically (Evans, Cullen, Burton, Dunaway, & Benson, 1997), cross-culturally (Vazsonyi, Pickering, Junger, & Hessing, 2001), and over time using multiple measures and informants (Moffitt et al., 2011; Tittle, Ward, & Grasmick, 2003; Wright, Caspi, Moffitt, & Silva, 1999). Yet, previous research has focused on poor self-control predicting overall criminal behavior, with both constructs conceptualized broadly. It is less known how self-control, or more specifically, impulsivity as displayed through a delay discounting task, influences crime over time, specifically different types of crime.

Delay discounting is a behavioral task focused on choosing between short-term, low incentive and long-term, high incentive monetary pay-offs (Kirby, Petry, & Bickel, 1999). Such a task mimics the real life decisions one makes when engaging in criminal behavior, where the immediate reward of crime may be overvalued compared to the long-term consequences. Moreover, crime itself may reinforce the tendency toward poor self-control through immediate gratification. However, few studies have examined this possibility. In addition to predicting criminal behavior from self-control, the current study expands on prior research by examining bidirectional relationships between delay discounting and different types of crime and how these relations change over a three-year period in a college sample.

Impulsivity and Crime

Self-control is defined by impulsivity, risk-taking behavior, and overall lack of restraint (Gottfredson & Hirschi, 1990). Previous work has found that self-control in childhood and adolescence predicts later delinquency (Longshore, 1998; Moffitt et al., 2011; Wright et al., 1999), even when controlling for confounding variables such as childhood conduct problems and gender (Fergusson, Boden, & Horwood, 2013; Moffitt et al., 2011).

Within self-control is the specific facet of impulsivity, which the current study defines as the need for immediate gratification regardless of long-term consequences (Gottfredson & Hirschi, 1990). Impulsivity has been linked to drug use and crime (Loeber et al., 2012; Perry & Carroll, 2008). However, previous work has focused on self-reports of impulsivity using a rating scale. Such reports require participants to recall past behavior and characterize themselves on a comparative basis to others in the population (Odum, 2011), which may not always be accurate.

Delayed discounting is a specific measure of behavioral impulsivity that tests whether participants favor earlier, smaller monetary rewards over future, larger rewards (Kirby et al., 1999). During the task, participants indicate if they would choose an immediate, smaller monetary reward or a larger monetary reward provided at a later time with the amount of money and time varying across questions. Those who more frequently choose the immediate monetary reward, thus displaying higher rates of discounting, are thought to be more impulsive, unable to wait another week or month in order to receive the higher monetary value. Unlike other self-report questionnaires, delayed discounting acts as a more “real-world” and salient behavioral choice with relatable consequences. Therefore, delay discounting may more accurately parallel the judgments people make when considering

risky behavior. Moreover, those who discount monetary rewards may also discount the potential negative consequences resulting from their actions in favor of immediate gain (Critchfield & Kollins, 2001). Indeed, delayed discounting correlates with higher rates of aggression (Miller, Lynam, & Jones, 2008) and childhood conduct disorder (Bobova, Finn, Rickert, & Lucas, 2009). More specifically, higher rates of discounting predict various types of crimes, including property crime and violent crime (Nagin & Pogarsky, 2004). Those who engage in property crime or violent crime may overvalue the immediate reward of a stolen candy bar or exacting revenge through physical aggression. Delayed discounting appears to tap into the same type of impulsivity related to criminal behavior.

Delay Discounting and Types of Crime

Some studies have related delayed discounting to different types of crime, rather than just the overall construct of criminal behavior. Within a parolee sample, those who had a history of violent crime discounted more than parolees without such a history, with results consistent for both genders (Cherek & Lane, 1999; Cherek, Moeller, Dougherty, & Rhoades, 1997). Higher rates of discounting also predicted more violent behavior among the general population (Moore & Foreman-Peck, 2009). Nagin and Pogarsky (2004) found that adolescents who displayed higher discounting rates committed more property crimes later. Last, there is a robust relationship between higher rates of delayed discounting and drug use (MacKillop et al., 2011). These findings suggest that delayed discounting serves as a useful proxy for one's inability to delay receipt of reward and that this characteristic relates to several criminal outcomes. Therefore, those who are more likely to discount monetary rewards may also go on to pursue the immediate gains received from committing crimes.

Reciprocal Relations between Delayed Discounting and Crime

The literature remains remarkably sparse regarding longitudinal and reciprocal relationships between different types of crime and how they may relate to delayed discounting, especially within a single sample. Prior studies have focused on impulsivity predicting crime rather than examining how they may mutually affect one another. Exploring this possibility is crucial for understanding the persistence of criminal behavior over time. Should one's inability to delay rewards remain static, treatment would only need to address the base level of impulsivity to thwart future untoward behavior.

Engaging in successful criminal activity may further reinforce one's inability to delay reinforcement. This increase in impulsivity might, in turn, encourage more criminal activity. Akers' Social Learning Theory is regarded by many as a leading theory of criminality (Agnew, 1999). This theory posits that ongoing, reciprocal causal relationships between misconduct and social learning concepts (e.g., differential reinforcement) serve as teaching tools to individuals who engage in criminal activity (Akers, 1998). Successful experiences lead to further engagement in crime. Some evidence suggests that successful experiences with criminal activities do reinforce attitudes and beliefs about crime (Tittle, Antonaccio, & Botchkovar, 2012), indicating a possible bi-directional relationship between reward and crime.

The Current Study

The current study examines how delay discounting and self-reported criminal activity may predict one another over a three-year period in a large sample of college students. Participants began the project in their first year of college and returned during their second and third years, therefore providing both delayed discounting and past year criminal behavior reports at multiple time points. Moreover, 23.1% of the sample was comprised of participants who scored in the upper 25th percentile on a screening measure of conduct problems in adolescence in order to ensure behavioral variability among participants. This study allowed us to examine the reciprocal relationship between delay discounting and crime over time while accounting for previous levels of both. Further, we assessed three distinct types of crime: violent crime, property crime, drug crime, and overall crime. We predicted that higher rates of delay discounting, or the tendency to choose smaller, more immediate rewards, will predict all forms of later criminal behavior though relations will be stronger over shorter periods (e.g., one year) versus longer periods of time (e.g., two years) due to attenuation of effects. Although there is currently no research in this area, theory regarding reinforcing effects of crime and evidence of attitude change from crime (Akers, 1998; Tittle et al., 2012) allowed us to predict that higher levels of self-reported criminal behavior will increase later levels of discounting, thereby supporting the possibility of a bi-directional effect.

Materials and Methods

Participants

In the current study, 526 undergraduates ($M=18.95$ years, $SD=0.77$, 48% male, 81% Caucasian) were collected across two cohorts ($n=230$ for cohort 1, $n=296$ for cohort 2). Participants were recruited from undergraduate introductory psychology courses at a public university in the southern United States. Participants received both course credit and monetary incentives. Participants who scored in the upper 25th percentile on a screening measure were specifically overrecruited. The screening took place during the first two weeks of the semester and assessed conduct problem behaviors that occurred prior to age 18 (e.g., stealing, lying). Those whose scores fell within the top 25% of the sampling pool for their gender were specifically invited to participate through email to ensure sufficient variability in delinquent behaviors. Participants scoring in the top 25% of the sampling pool comprised 23.1% of the final sample.

Procedure

Participants arrived at the laboratory and completed multiple measures and tasks, including informed consent in line with IRB guidelines, as part of a larger study examining the longitudinal relationship between personality traits and substance use in a college sample. For this specific study, participants completed a questionnaire about criminal behavior in the last year and a delay discounting task on the computer (see Table 1 for descriptives). Participants were contacted by email and phone to return in their second ($n=386$) and third years ($n=332$). Three hundred (57%) participants returned for all three years (see Data Analysis section for how we dealt with missing data).

Measures

Crime and Analogous Behavior scale (CAB)—The CAB (Lynam, Whiteside, & Jones, 1999; Miller & Lynam, 2003) is a 69-item self-report measure assessing participants' involvement in various criminal behaviors, such as theft or physical altercations, with a subset of 30 items used in the current study. Participants endorsed yes (1) or no (0) based on if they had ever participated in each behavior. The mean response, ranging from 0-1, for specific subscales of violent crime (e.g., attacked someone), property crime (e.g., stealing), drug crime (e.g., sold drugs), and total crime (sum of all items) was used in analyses.

Monetary Choice Questionnaire (MCQ)—The MCQ is a 27-item behavioral task that asks participants to choose between a hypothetical smaller monetary reward today versus a larger monetary reward sometime in the future (Kirby et al., 1999). Monetary value and length of delay varied per question (e.g., Would you prefer \$54 today OR \$55 in 117 days?) with length of delay ranging from 7-186 days and monetary values ranging from \$11-\$85. The proportion of times participants chose the larger, delayed reward was calculated, with higher values indicating less discounting (Myerson, Baumann, & Green, 2014). Current items displayed sufficient internal consistency ($\alpha=0.90-0.91$). No actual monetary rewards were provided in association with task performance.

Data Analysis

Data were analyzed using structural equation modeling in Amos 21. Models were fully saturated (i.e., 0 df); therefore, fit indices were not available. When examining attrition effects, there were two significant correlations out of 10 between those who did not return in year 2 or year 3 and baseline measures: property crime in wave 1 ($r=0.10$, $p=0.03$) and total crime in wave 1 ($r=0.09$, $p=0.03$). Therefore, full information maximum likelihood estimation (FIML) or multiple imputation were used to account for missing data. Type of analysis was chosen based on the normality or non-normality of variables. For normally distributed variables, missing data were handled using FIML. For models where variables were non-normally distributed (i.e., substance use crime, violent crime, total crime), asymptotic distribution free analysis was used (ADF). ADF makes no distributional assumptions, thus making it appropriate for data with large skewness or kurtosis values (Browne, 1984; Kline, 2005). However, ADF does not allow for missing data; therefore, multiple imputation was utilized with reported values obtained by averaging across five imputed datasets (Schafer & Graham, 2002; Schafer & Olsen, 1998). Types of crime were analyzed by subscale. Correlations among variables are provided in Table 2. Gender was not a significant covariate; therefore, the following results are presented without gender included in the analyses.

Results

Delay discounting and property crime

Initial levels of delay discounting and self-reported property crime were entered as predictors of both delay discounting and crime one and two years later. There were no significant cross-lag relations from year 1 to year 2. However, as predicted, a higher level of delay discounting in year two was a significant predictor of increased property crime one

year later (see Figure 1; $\beta=-0.09$, $p=0.02$). Thus, those who more frequently chose smaller, more immediate rewards during their second year of college later endorsed more property crimes during their third year of college.

Contrary to hypotheses, property crime was not a significant predictor of delay discounting one year later ($\beta=0.04$, $p=0.27$). Both delay discounting and property crime displayed high stability over time ($\beta=0.75$, $p<0.001$ and $\beta=0.73$, $p<0.001$ respectively), emphasizing the reliability of these measures. The overall model explained 53% of the variance in property crime and 56% of the variance in delay discounting in year three. Delay discounting accounted for 0.7% of the unique variance in later property crime.

Further, this same relationship was largely replicated over a two-year period. When predicting property crime in year three, higher levels of delay discounting during year one showed a similar, yet marginal, relationship with greater property crime (see Figure 2; $\beta=-0.08$, $p=0.07$). Those who more frequently chose sooner, smaller rewards were more likely to endorse property crimes two years later. Once again, increased property crime did not predict later discounting of monetary rewards ($\beta=0.01$, $p=0.83$). These results suggest a consistent relationship between increased levels of delay discounting and later endorsement of property crime. Regression weights were comparable across both models, suggesting that the latter model was likely underpowered to reach significance due to attrition. These results align with the hypothesis that relationships would be weaker over longer periods of time. Delay discounting ($\beta=0.61$, $p<0.001$) and property crime ($\beta=0.64$, $p<0.001$) continued to show strong stability over time. In this model, 42% of the variance in property crime and 37% of the variance in delay discounting from year three were explained with delay discounting explaining 0.6% of the unique variance in property crime.

Delay discounting and violent crime

Consistent with hypotheses, higher levels of violent crime as reported in the first year of college predicted higher levels of delay discounting one year later (see Figure 3; $\beta=-0.09$, $p=0.03$). Those who endorsed more violent crime were more likely to choose smaller, more immediate monetary rewards a year later. However, delay discounting at year 1 did not predict violent crime at year 2 ($\beta=0.001$, $p=0.99$). Once again, delay discounting ($\beta=0.57$, $p<0.001$) in years 1 and 2 were highly correlated as well as violent crime ($\beta=0.45$, $p<0.001$) in years 1 and 2, emphasizing the reliability and validity of these measures. In this model, 34% of the variance in delay discounting and 21% of the variance in violent crime were explained. Violent crime explained 0.9% of the unique variance in delay discounting. No other models of violent crime and delay discounting were significant.

No models with delay discounting and drug use or delay discounting and total crime were significant.

Discussion

Crime is a dangerous and costly societal concern. Previous work suggests that poor self-control is a key contributor to criminal behavior (Gottfredson & Hirschi, 1990), with deficient self-control linked to outcomes such as health, wealth, and drug use (MacKillop et

al., 2011; Moffitt et al., 2011). Further, successful criminal activity is likely to reinforce one's inability to delay gratification, thereby creating a reciprocal trend of characteristic impulsivity and criminal activity (Akers, 1998). The current study utilized these theoretical perspectives in an examination of the reciprocal relationship between behavioral impulsivity during a delay discounting task and different criminal behaviors (e.g., violent, property, drug use) over time.

Congruent with our hypotheses, higher rates of delay discounting, or the preference for smaller, more immediate rewards, were significantly related to higher endorsement of property crime one and two years later. This relationship was significant even when controlling for initial levels of both delay discounting and crime. Delay discounting acts as a salient, real-life task of hypothetical monetary rewards that may tap into the same decision-making process one might use when engaging in property crime. The decision to steal a candy bar, for instance, may be a decision based upon salience of rewards rather than the result of long-term planning and careful consideration of consequences. Both property crime and delay discounting may thus tap into a desire for immediate gratification or rewards.

In support of the idea that crime can influence one's attitudes and characteristics (Akers, 1998; Tittle et al., 2012), violent crime was related to future delay discounting. Those who endorsed more violent crimes were more likely to choose smaller, immediate rewards one year later. To our knowledge, this is the first study to find that higher levels of criminal behavior were related to higher levels of later delay discounting after controlling for initial levels of both. However, more delay discounting did not in turn relate to violent criminal behavior 1 year later. Certainly, the reinforcing effects of violence have been established, suggesting that violence is clearly linked with reward pathways (Couppez & Kennedy, 2008). These results mirror previous work that found negative urgency, or the decision to act impulsively when experiencing negative emotions, was specifically related to intimate partner violence (Derefinko, DeWall, Metze, Walsh, & Lynam, 2011). Those who commit a violent act may feel rewarded and thus positively reinforced for their impulsive behavior, encouraging future discounting tendencies. This positive reinforcement may serve as encouragement to make similarly impulsive decisions that lead to short-term gratification for those who commit violent crimes.

What differentiates violent and property crime may be the severity and intensity of the behaviors. Indeed, the most commonly endorsed property crime item in this sample was "Have you ever stolen (or tried to steal) something worth \$5 or less?" ($M=0.50-0.54$, $SD=0.50$ over three waves), as opposed to the most commonly endorsed violent crime item "Have you ever been in a physical fight with another individual?" ($M=0.39-0.42$, $SD=0.49$ over three waves). Moreover, since crime may be motivated by multiple pathways, it is possible that violent crime is motivated by a more "hot," emotional pathway whereas property crime may be motivated by a more "cool," rational pathway. Thus, future work may continue to tease apart the different pathways to varying types of crime.

This study provided additional evidence of differential relations between delay discounting and different types of crime. Such results emphasize the relevance of behavioral impulsivity, as displayed by a delay discounting task, to criminal behavior. While two of the types of

crime related in hypothesized ways to delayed discounting, it is quite surprising that delayed discounting was not a significant predictor of drug-related crime given that drug crimes are similar to other forms of crime. It may be the case that the illegal drug-related behaviors utilized in this construct represent acts that are motivated by multiple pathways. For instance, driving under the influence of alcohol or drugs is arguably more prevalent and less severe a crime than selling cocaine (Dorsey & Middleton). Although some form of impulsivity may underlie both behaviors, perhaps these behaviors are not equally captured by delayed discounting in particular. Another reason may be that drug crimes are overall low base rate behaviors, thus lacking variability in this sample.

Though this study focused on a college sample, future work may examine the implications for a clinical sample as well. For example, evidence that the inability to delay rewards may serve as a risk factor for criminal activity suggests that treatments that address this characteristic may serve as effective preventative measures in individuals prior to the onset of crime and delinquency. Enhancement of the understanding of how one's behavior fits with life goals is a component of successful substance use treatment (Barrowclough et al., 2001; Bickel, DeGrandpre, & Higgins, 1993). Although substance use and violence are characterized by very different structural brain alterations (Schiffer et al., 2011), there may be common underlying risk factors that can be mutually addressed. The other finding of this work, that crime appears to reinforce discounting deficits, suggests that treatment regarding this deficit should be greatly enhanced in those who are already engaged in criminal activity. It is possible that purposeful strengthening of skills that enable individuals to successfully engage in long-term goal-consistent behavior may be a key to reducing reoffending.

Limitations

The current study was not without limitations. Though study participants were overrecruited to increase variability of behaviors, there was still a rather low base rate of criminal behavior. Future work should continue to examine these constructs in a variety of populations and age groups, particularly in clinical samples. Further, criminal behavior may be motivated by a variety of factors, such as aggression, emotion regulation, and other forms of impulsivity. Indeed, Romer, Duckworth, Sznitman, & Park (2010) found that delay discounting and drug use may function differently among those with varying levels of sensation seeking. Therefore, other possible motivators of criminal behavior should continue to be studied. Future work should also investigate different methods of measuring impulsivity and criminal behavior to investigate possible bi-directional relations across other forms of assessment. For instance, the current study asked participants to self-report on criminal behavior. However, incorporating other methods, such as public records, may be more accurate. Lastly, delay discounting focuses on immediate reward gratification, but does not directly address aversion to punishment. Rewards and costs are motivated by differential pathways; therefore, aversion to punishment, or lack thereof, is another relevant trait that should be investigated further for those committing criminal acts.

Crime is a multi-faceted construct, providing many avenues for intervention. By better understanding the underlying causes of crime, only then can we as a society begin to address prevention. The value of delay discounting to both predict and be predicted by different

criminal behavior adds hope to this issue. If we are able to recognize and identify those at risk for criminal behavior, we are able then to utilize more effective and targeted prevention and intervention strategies.

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Highlights

- The study examines how delay discounting and crime predict one another over time.
- Higher rates of delay discounting predicted property crime one and two years later.
- Higher levels of violent crime were related to higher rates of delay discounting.
- Helping people engage in long-term goal-consistent behavior may reduce reoffending.

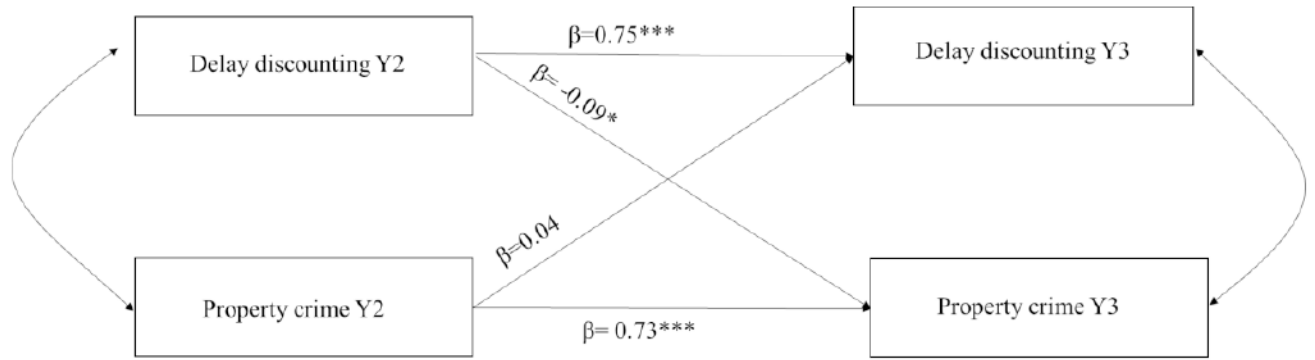


Figure 1.

Delay discounting predicts property crime one year later. Property crime $R^2=53\%$, delay discounting $R^2=56\%$.

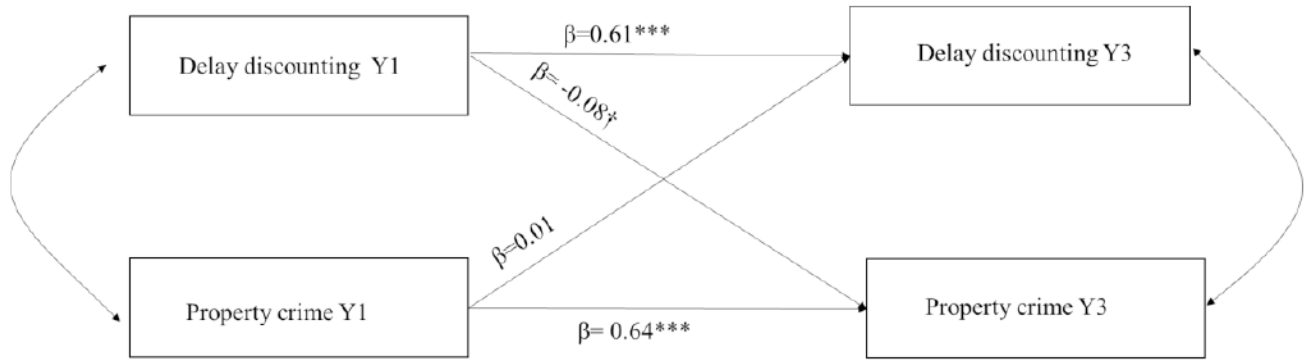


Figure 2. Delay discounting predicts property crime two years later. Property crime $R^2=42\%$, delay discounting $R^2=37\%$.

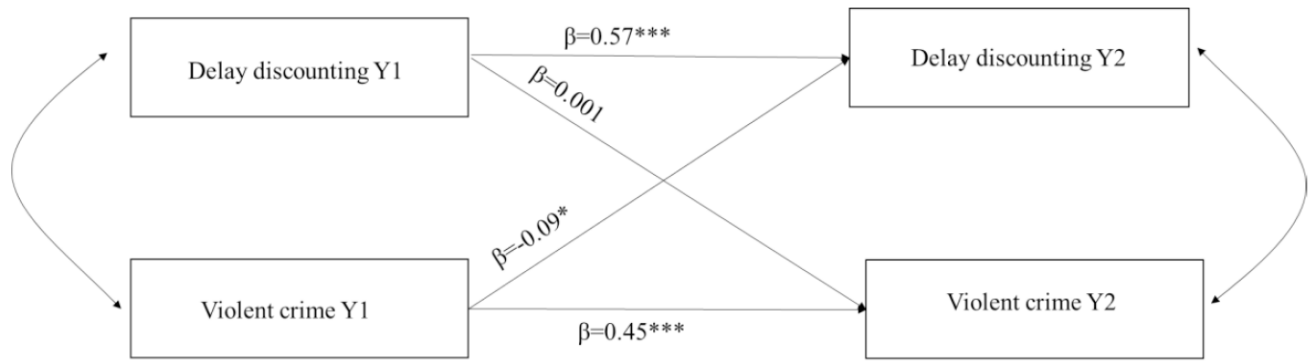


Figure 3.

Violent crime predicts delay discounting one year later. Delay discounting $R^2=0.34$, violent crime $R^2=0.21$.

Table 1

Means and standard deviations

| | Year 1 | | Year 2 | | Year 3 | |
|---|----------|-------------|----------|-------------|----------|-------------|
| | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> |
| Property crime | 0.18 | (0.22) | 0.19 | (0.22) | 0.19 | (0.21) |
| Violent crime | 0.14 | (0.19) | 0.14 | (0.19) | 0.12 | (0.18) |
| Drug Crime | 0.04 | (0.13) | 0.06 | (0.15) | 0.06 | (0.14) |
| Total Crime | 0.13 | (0.14) | 0.14 | (0.15) | 0.13 | (0.13) |
| Proportion of larger delayed rewards chosen | 0.43 | (0.19) | 0.41 | (0.17) | 0.42 | (0.18) |

Table 2

Correlations among variables

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|-------------------|--------------------|---------|--------------------|--------------------|---------|-------------------|---------|---------|--------------------|---------|---------|---------|-------|----|
| Wave 1 | | | | | | | | | | | | | | | |
| 1. Property crime | 1 | | | | | | | | | | | | | | |
| 2. Violent crime | 0.41*** | 1 | | | | | | | | | | | | | |
| 3. Drug crime | 0.40*** | 0.37*** | 1 | | | | | | | | | | | | |
| 4. Total crime | 0.90*** | 0.72*** | 0.61*** | 1 | | | | | | | | | | | |
| 5. Proportion of larger delayed rewards chosen | -0.36*** | -0.01 | -0.07* | -0.06 [†] | 1 | | | | | | | | | | |
| Wave 2 | | | | | | | | | | | | | | | |
| 6. Property crime | 0.67*** | 0.16** | 0.15** | 0.36*** | -0.08 [†] | 1 | | | | | | | | | |
| 7. Violent crime | 0.15* | 0.45*** | 0.12* | 0.30*** | -0.01 | 0.58*** | 1 | | | | | | | | |
| 8. Drug crime | 0.27*** | 0.21*** | 0.48*** | 0.35*** | -0.06 | 0.54*** | 0.43*** | 1 | | | | | | | |
| 9. Total crime | 0.35*** | 0.30*** | 0.23*** | 0.40*** | -0.03 | 0.94*** | 0.79*** | 0.67*** | 1 | | | | | | |
| 10. Proportion of larger delayed rewards chosen | -0.03 | -0.09 [†] | -0.07 | -0.09 [†] | 0.59*** | 0 | -0.03 | 0 | 0 | 1 | | | | | |
| Wave 3 | | | | | | | | | | | | | | | |
| 11. Property crime | 0.65*** | 0.14** | 0.13* | 0.32*** | -0.10* | 0.72*** | 0.11* | 0.14* | 0.28*** | -0.08 [†] | 1 | | | | |
| 12. Violent crime | 0.11 [†] | 0.55*** | 0.18*** | 0.32*** | -0.03 | 0.19** | 0.57*** | 0.15** | 0.33*** | -0.10* | 0.38*** | 1 | | | |
| 13. Drug crime | 0.19*** | 0.12* | 0.34*** | 0.24*** | -0.06 | 0.07 | 0.09 [†] | 0.42*** | 0.16** | -0.04 | 0.28*** | 0.28*** | 1 | | |
| 14. Total crime | 0.64*** | 0.31*** | 0.23*** | 0.40*** | -0.12** | 0.72*** | 0.29*** | 0.24*** | 0.36*** | -0.09* | 0.88*** | 0.66*** | 0.55*** | 1 | |
| 15. Proportion of larger delayed rewards chosen | -0.03 | -0.07 | -0.03 | -0.07 | 0.61*** | 0.03 | -0.05 | -0.03 | 0 | 0.75*** | 0 | -0.03 | 0.01 | -0.04 | 1 |

[†] $p < 0.10$,

* $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$