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Jeffrey N. Weatherly
University of North Dakota, jeffrey_weatherly@und.nodak.edu

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DO SCORES ON THE GAMBLING FUNCTIONAL ASSESSMENT—REVISED PREDICT DISCOUNTING OF DELAYED GAINS AND/OR LOSSES IN A UNIVERSITY SAMPLE?

Jeffrey N. Weatherly
University of North Dakota

The present study investigated whether participants' scores on the Gambling Functional Assessment – Revised (GFA-R) would be predictive of their level of discounting of delayed hypothetical monetary gains and losses. One hundred twenty eight university students completed the GFA-R and a discounting task involving two hypothetical monetary amounts that were framed either as gains or losses. Participants endorsed gambling for positive reinforcement significantly more than gambling for negative reinforcement. They discounted losses significantly more than gains and displayed a magnitude effect for losses (the effect was not statistically significant for gains). GFA-R scores were significant predictors of discounting for only the outcome of losing $1,000. Gambling for positive and negative reinforcement predicted more or less discounting, respectively. The results suggest that the GFA-R may be a useful research tool, that one cannot assume that discounting of gains will be informative about the discounting of losses, and that the contingencies that may be maintaining a person's gambling behavior may not be informative as to how that person discounts particular outcomes.

Keywords: gambling functional assessment-revised, discounting, magnitude effect, multiple-choice method, university students

Pathological gambling is a great societal concern, with research suggesting that 1 – 2% of the population suffers from the disorder (see Petry, 2005, for a review). That being the case, it should come as no surprise that much research has been conducted on developing measures that can identify potential pathological gamblers (e.g., the South Oaks Gambling Screen (SOGS), Lesiuer & Blume, 1987; Stinchfield, 2002). Likewise, much research has been directed at identifying the potential processes that might underlie, cause, and/or maintain the disorder (e.g., see Petry, 2005).

Although there have been numerous attempts to create measures to identify potential pathology, attempts to create measures that potentially identify why a person gambles have been far more sparse. The initial attempt to do so was made by Dixon and Johnson (2007), who proposed the Gambling Functional Assessment (GFA). The GFA is a 20-item self-report questionnaire designed to potentially identify four different contingencies (i.e., gambling for tangible outcomes like money, for the sensory experience, for the social aspects, or as an escape) that might be maintaining the respondent's behavior. Five items are associated with each contingency and the highest-endorsed contingency is theorized to be the primary maintaining contingency of the respondent's gambling behavior.

Subsequent psychometric research on the GFA (Miller, Meier, Muehlenkamp, & Weatherly, 2009), however, suggested that the instrument did not function exactly as it was designed. Specifically, Miller et al. (2009) demonstrated that although the GFA was designed to measure four possible maintaining contingencies, exploratory and con-

Address all correspondence to:
Jeffrey N. Weatherly
Department of Psychology
University of North Dakota
Grand Forks, ND 58202-8380
email: jeffrey.weatherly@email.und.edu

firmatory factor analyses indicated that it only measured two (i.e., gambling for positive and negative reinforcement). Additionally, not all of the 20 items were associated with one of these two factors, whereas some items were associated with both.

These findings led Weatherly, Miller, and Terrell (2011) to construct the GFA – Revised (GFA-R). The GFA-R is a 16-item self-report questionnaire, similar to the GFA (Dixon & Johnson, 2007), that was designed to identify gambling for positive and negative reinforcement. Eight items are associated with each contingency. Weatherly et al. reported that all 16 items cleanly and strongly associate with one of these two contingencies. Further, Weatherly, Miller, Montes, and Rost (in press) reported that the GFA-R has better temporal reliability and internal consistency that the original GFA. However, whereas the original GFA has been proven to be a valuable research tool (e.g., Miller, Dixon, Parker, Kulland, & Weatherly, 2010; Weatherly, Montes, & Christopher, 2010), little research has yet been conducted with the GFA-R.

In terms of processes that underlie gambling behavior, one that has received a good deal of attention is what is known as discounting (e.g., Petry & Madden, 2010). Discounting is said to occur when the subjective value of a consequence is altered because its delivery is either delayed or uncertain (see Madden & Bickel, 2010, for a review of discounting). For example, if you were willing to accept $9 today rather than waiting one week to get $10, then that decision would indicate that the delay of one week had decreased the subjective value of the $10 by at least 10%. The general finding is that, for delay discounting, the subjective value of a reinforcing outcome decreases as the delay to its delivery increases (see Madden & Bickel, 2010).

Researchers have speculated that the process of discounting is involved in the disorder of pathological gambling for both theoretical and empirical reasons. Theoretically, one might expect individuals displaying impulse-control disorders (e.g., pathological gambling) to possess a general preference for more immediate outcomes (e.g., see Yi, Mitchell, & Bickel, 2010, for a discussion). Empirically, numerous studies have found an association between discounting and the problem/pathological gambling (see Petry & Madden, 2010, for a recent review). Although the not always the case (e.g., Holt, Green, & Myerson, 2003), the majority of published studies have reported that pathological gamblers discount delayed rewards at a greater rate than non-pathological gamblers (see Petry & Madden, 2010). In other words, while a non-gambler might be willing to accept $9 today instead of waiting one week for $10, a pathological gambler might be willing to accept $7.

Research that has linked gambling behavior and delay discounting has been conducted by measuring discounting of delayed rewards. Doing so has face validity given that gamblers stand to gain something if they win. On the other hand, gamblers also stand to lose something if they do not win. It is possible to measure discounting of losses rather than, or in addition to, discounting of gains (e.g., Holt, Green, & Myerson, 2008). The absence of research on gambling and discounting of losses is intriguing because one might speculate that people might treat losses differently than gains. Furthermore, research with both the GFA (Dixon & Johnson, 2007) and the GFA-R (Weatherly et al., 2011, in press) has indicated that individuals gamble for different reasons. It would seem reasonable to suspect that such individuals might also treat gains and losses differently.

Existing evidence suggests that differences are found between the discounting of gains and losses. For instance, one reliable finding in the literature on delay discounting of gains is what is known as the magnitude effect (Thaler, 1981); the level of discounting varies inversely with the magnitude of the outcome being discounted. For example, although you might be willing to accept $9 today rather than waiting one week for $10, it is unlikely you would be willing to accept $9,000 today rather than waiting one week for $10,000, indicating that your level of discounting has decreased because the amount of the outcome has increased. Estle, Green, Myerson, and Holt (2006) reported finding reliable magnitude effects when participants discounted gains. However, a magnitude effect for discounting losses was not reliably observed. These two scenarios may also produce different absolute rates of discounting. Shelley (1994), for instance, reported finding greater levels of delay discounting for delayed losses than for delayed gains.

Although researchers have not investigated the connection between gambling and discounting of both gains and losses, they have investigated how other subject variables might differentially affect discounting of gains and losses. Ohmura, Takahashi, and Kitamura (2005) showed that nicotine self-administration (i.e., smoking) was associated with how individuals discounted delayed gains, but not with how they discounted delayed losses. Ostaszewski and Karzel (2007) found that lower-income participants discounted both delayed gains and losses at a greater rate than higher-income participants. Thus, research has suggested that delay discounting of gains and losses may not vary the same way as a function of the same manipulations and that certain variables may influence both types of discounting similarly or one type of outcome but not the other.

If pathological gamblers are more impulsive than non-gamblers, then one might predict that they would display different levels of discounting of both delayed gains and losses. However, it should be noted that gambling as an escape appears to be more strongly related to pathological gambling than gambling for positive reinforcement (Miller et al., 2010). One could therefore speculate that the heightened levels of discounting of gains by pathological gamblers might occur because they are avoiding the potential loss of the outcome. By that rationale, however, one would then speculate that people who gamble as an escape might display lesser levels of discounting of losses because it avoids having to sustain the full loss later. As noted above, whether this outcome is observed is yet unknown.

The present study was a preliminary attempt test the above ideas and was designed with several goals in mind. The first goal was to determine if the GFA-R could serve as a valuable research tool. Several such measures of value would be the instrument's ability to produce reliable results and distinct subscale scores. The second goal was to determine whether different levels of discounting would be observed for gains and losses and whether the observed rates would be differentially associated with the contingencies that were likely maintaining the respondent's gambling behavior.

Undergraduate students were recruited to complete the GFA-R and then a delay-discounting task that involved four different outcomes. Specifically, each participant completed the discounting task for two hypothetical gains and two hypothetical losses. The two outcomes varied in magnitude and the same magnitudes of the outcomes were used for both the gain and loss scenarios. Although the participants were not necessarily pathological gamblers, their participation was deemed appropriate because the above goals did not, at a theoretical level, depend on the presence or absence of pathology.

Given the previous research on the GFA-R, the hypothesis in the present study was that participants would score higher on gambling for positive reinforcement than for negative reinforcement. Given previous research on delay discounting of gains and losses, the hypotheses were that participants would discount delayed losses to a greater degree than they would gains and that a magnitude effect would be observed for discounting of gains but not for discounting of losses. In terms of GFA-R scores, it was hypothesized that participants' scores on gambling as an escape would be inversely related to discounting of gains and directly related to discounting of losses. The opposite predictions were made for participants' scores on gambling for positive reinforcement.

METHOD

Participants

The participants were 128 undergraduate students (107 females; 21 males) who were enrolled in a psychology course at the University of North Dakota. The sample was a convenience sample; pathological gamblers were not directly targeted for participation. The mean age of the participants was 19.7 years (SD = 2.7 years) and their self-reported grade point average was 3.4 out of 4.0 (SD = 0.5). The vast majority of the participants reported being Caucasian (94.5%), unmarried (96.9%), and making less than $10,000 per year in income (93.0%). Participants received (extra) course credit in their psychology course in return for their participation.

Materials and Procedure

Participants completed the study using an online research administration program (SONA Systems, Ltd; Version 2.72; Tallinn, Estonia). This program was accessible to them through their psychology course. The program tracked participation by individual participants, which ensured that no individual could participate in the study more than one time regardless of how many psychology courses in which the individual was enrolled that semester. The present study was completed within one semester.

Before beginning the procedure, the participant was presented with informed-consent information, which described the study as approved by the Institutional Review Board at the University of North Dakota. Continued participation in the study beyond this information constituted the granting of informed consent.

The first measure participants completed was a demographic questionnaire. This instrument asked the participants to report their sex, age, grade point average, race, marital status, and annual income.

The second measure participants completed was the GFA-R (Weatherly et al., 2011). The GFA-R is a 16-item self-report questionnaire intended to identify whether the respondent's gambling behavior is maintained by positive and/or negative reinforcement. Eight items are associated with each contingency and can be endorsed on a scale of 0 (never) to 6 (always). A representative item designed to measure gambling for positive reinforcement is "After I gamble, I like to go out and celebrate my winnings with others." A representative item designed to measure gambling for negative reinforcement is: "I gamble after fighting with my friends, spouse, or significant other." Research has suggested that the GFA-R has excellent construct validity (Weatherly et al., 2011), excellent internal consistency (Weatherly et al., in press), and good to excellent test-retest reliability (Weatherly et al., in press).

The third measure participants completed was a delay-discounting task. This task involved two different hypothetical monetary amounts ($1,000 or $100,000). Likewise, these different amounts were framed either as gains or as losses. The two different monetary amounts were used as an attempt to produce the magnitude effect (Thaler, 1981). The exact wording of each outcome can be found in the Appendix.

Participants completed five questions pertaining to each scenario. The questions differed in terms of the delay that was involved until the participant hypothetically gained, or had to pay, the full amount. The five different delays were 6 months, 1 year, 3 years, 5 years, and 10 years. The procedure used to determine the indifference point at each delay was the multiple-choice method (Beck & Triplett, 2009). Specifically, at each delay to the full amount, the participants selected the immediately available amount that was preferred relative to waiting. Participants selected from 51 possible outcomes, which varied in $20 or $200 increments from $0 to the maximum amount for the $1,000 and $100,000 outcomes, respectively. Although this method is not the most widely used method for collecting delay-discounting data, research using the multiple-choice method has demonstrated that it produces interpretable data (e.g., Beck & Triplett, 2009; Weatherly, Plumm, & Derenne, 2011) that are typically comparable to other methods (Weatherly & Derenne, 2011).

Participants completed all five questions pertaining to a particular outcome prior to completing the five questions pertaining to the next outcome (i.e., outcomes were presented serially), with the presentation of the five different delays to the outcome varying randomly across participants and outcomes. Likewise, the order that the four different outcomes were presented was varied randomly across participants.

Analysis of the Discounting Data

Rates of delay discounting were determined by calculating the area under the discounting curve created using Equation 1 (Myerson, Green, & Warusawitharana, 2001):

$$[x_2 - x_1] \text{ x } [(y_1 + y_2)/2] \quad \text{(Equation 1)}$$

With Equation 1, area under the curve (AUC) is calculated by summing the areas of the successive trapezoids. The resulting AUC value represents a proportion that can range between 0.0 and 1.0. Smaller AUC values are indicative of greater levels of discounting and larger AUC values are indicative of lesser or no discounting.

Equation 1 is not the only possible method for analyzing delay-discounting data, nor is it the most frequently used method (see Madden & Bickel, 2010, for a discussion). It was used in the present study for several reasons. First, it is atheoretical about the form the discounting data should follow, rather than assuming that discounting will take a certain form (e.g., a hyperbola; Mazur, 1987). Second, AUC values directly represent the data, rather than being estimated from the data.[1] Lastly, AUC values are typically parametric and therefore do not require transformation prior to conducting parametric statistical analyses, which is not the case with other methods.

RESULTS

Participants' scores on the positive and negative reinforcement sections of the GFA-R were compared by conducting a related-samples t test. Results indicated that participants scored significantly higher on gambling for positive reinforcement (Mean = 11.72, SD = 12.36) than they did for negative reinforcement (Mean = 1.84, SD = 5.40; Wilcoxon signed ranks test, $p < .001$). Scores on the positive reinforcement subscale ranged from 0 – 39, with 39.1% of the participants scoring 0. Scores on the negative reinforcement subscale ranged from 0 – 28, with 77.3% of the participants scoring 0. Results from this analysis, and all the follow, were considered significant at $p < .05$.

Figure 1 displays the mean AUC values that were observed for each hypothetical monetary amount when it was framed as a gain or a loss. Several results are apparent in Figure 1. First, participants discounted losses to a greater extent than they did gains. Second, a magnitude effect was observed for both gains and losses, but the direction of the effect varied by how the amount was framed. Whereas

[1] One could argue that AUC does assume that discounting between the different delays, five in this study, is linear. That assumption may or may not be true.

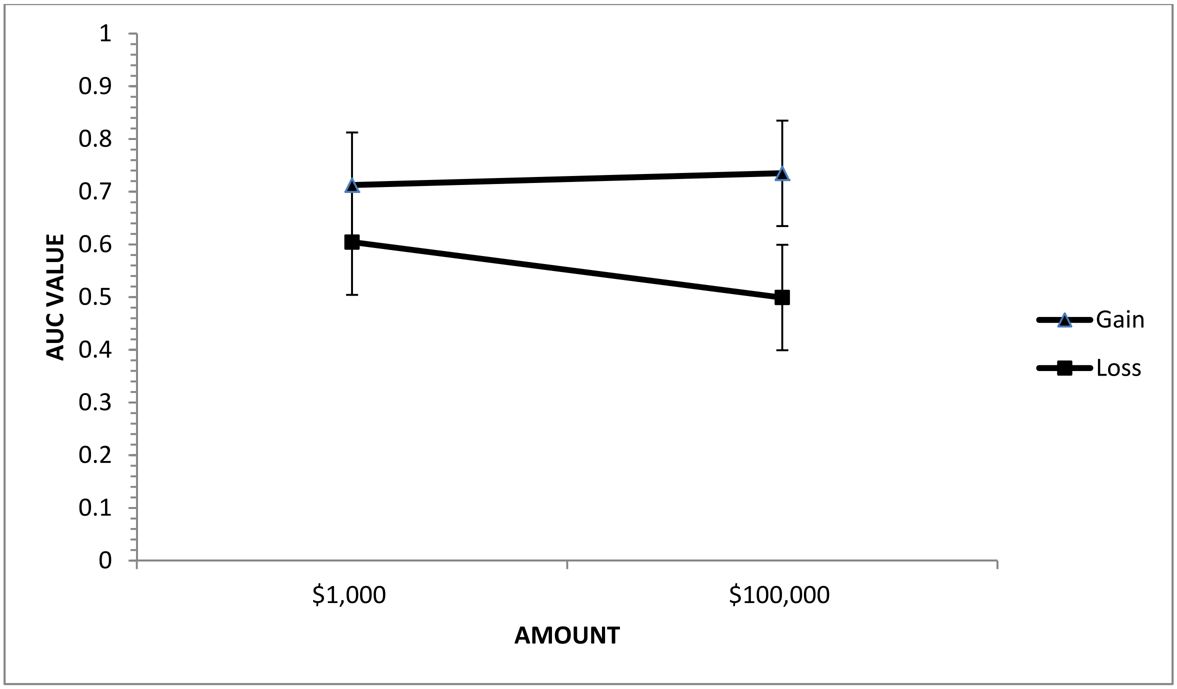

Figure 1. Presented are the mean AUC values for each hypothetical monetary amount when it was framed as a gain or a loss. The error bars represent one standard error of the mean across participants for that particular outcome.

participants displayed a small tendency to discount \$100,000 less (i.e., higher AUC values) than they did \$1,000 when the amounts were gains, they discounted \$100,000 more than they did \$1,000 when the amounts were losses.

The results from statistical analyses generally supported these observations. The data used to construct Figure 1 were subjected to a two-way (Type of Outcome X Monetary Amount) repeated-measures analysis of variance. The main effect of type of outcome was significant, $F(1, 127) = 47.30$, $p < .001$, $\eta^2 = .271$, indicating that participants discounted losses to a greater extent than they did gains. The main effect of monetary amount was significant, $F(1, 127) = 7.45$, $p = .007$, $\eta^2 = .055$, indicating that participants discounted \$100,000 to a greater extent than they did \$1,000. Lastly, the interaction between type of outcome and monetary amount was also significant, $F(1, 127) = 22.15$, $p < .001$, $\eta^2 = .148$, indicating that how the different amounts were discounted varied as a function of whether the amounts were to be gained or lost.

Because of the significant interaction, tests of simple effects were conducted. Results showed that participants discounted losing both \$1,000, $F(1, 127) = 13.46$, $p < .001$, $\eta^2 = .096$, and \$100,000, $F(1, 127) = 74.27$, $p < .001$, $\eta^2 = .369$, significantly more than they did gaining those same amounts. The magnitude effect did not reach statistical significance when the participants discounted gains, $F(1, 127) = 1.54$, $p = .218$, $\eta^2 = .012$. However, the magnitude effect was significant when participants discounted losses, $F(1, 127) = 22.16$, $p < .001$, $\eta^2 = .149$.

To determine whether GFA-R scores predicted discounting rates of the different outcomes, a series of simultaneous linear regressions were conducted with AUC values for each outcome serving as the dependent measures and GFA-R scores on the positive and negative reinforcement subscales serving as the predictor variables.[2] Simultaneous regressions were employed because such analyses allow for determining the independent contribution of each predictor variable.

When discounting gaining $1,000 was analyzed, neither the regression model, $F < 1$, nor the predictor variables were statistically significant. The same result was observed when discounting gaining $100,000 was analyzed, $F < 1$. Thus, neither gambling for positive nor negative reinforcement predicted rates of discounting gains.

When discounting losing $1,000 was analyzed, the regression model was significant, $F(2, 127) = 3.82$, $p = .025$, $R^2 = .058$. Likewise, both GFA-R scores for positive reinforcement, $\beta = -0.20$, $p = .033$, and negative reinforcement, $\beta = 0.22$, $p = .019$, were significant predictors of discounting losing $1,000. Higher positive reinforcement scores were predictive of more discounting, whereas higher negative reinforcement scores were predictive of less discounting. When discounting losing $100,000 was analyzed, the regression model was not significant, $F(2, 127) = 1.05$, $p = .352$, $R^2 = .017$. Likewise, neither predictor variable was significant, although it can be noted that the direction of the relationship between the predictor variables and discounting was similar to that observed for discounting losing $1,000.

DISCUSSION

One hypothesis of the present study was that participants would endorse gambling as a function of positive reinforcement on the GFA-R (Weatherly et al., 2011) significantly more than they would as a function of negative reinforcement. The results supported that hypothesis. A second hypothesis was that participants would discount losses significantly more than they would gains. The results also supported that hypothesis. Next, it was hypothesized that a magnitude effect would be observed for discounting of gains, but not for discounting of losses. In terms of statistically significant results, exactly the opposite result was observed. Lastly, it was predicted that GFA-R scores for escape would be inversely related to discounting of gains and directly related to discounting of losses, whereas the opposite would be observed for GFA-R scores for positive reinforcement. These predictions were not supported when participants discounted gains, but were at least partially supported when participants discounted losses.

Weatherly et al. (2011) also reported finding higher positive reinforcement scores on the GFA-R than negative reinforcement scores. The present results suggest that outcome may be reliable. It should not be assumed, however, that positive reinforcement scores will always be higher than negative reinforcement scores. In fact, 3 of the 128 participants in the present study scored higher on negative than positive reinforcement on the GFA-R. Perhaps more importantly, these results should help inform practitioners how scores on the GFA-R should be interpreted. Specifically, one should not assume, if an individual scores the same on the positive and negative reinforcement subscales, that the individual's gambling is maintained equally by positive and negative reinforcement. Rather, given that most individuals score higher for positive reinforcement than for negative reinforcement, such a result might represent a disproportionate influence of gambling maintained by negative reinforcement.

In terms of discounting, finding that losses were discounted significantly more than gains

[2] One could argue that, because many participants scored 0 on the GFA-R subscales of either positive reinforcement or escape, the relationship between subscales scores and AUC values would not be linear. To address this concern, GFA-R subscale scores were coded as either 0 (subscale score = 0) or 1 (subscale score > 0) and the regression analyses reported in the Results section were repeated. The outcomes of these analyses were identical to those reported in the Results when the raw subscale scores were used as the predictor variables.

replicates previous research findings (Shelley, 1994). At a theoretical level, such a result would seem intuitive if one assumes that rates of discounting will vary as function of the value of the outcome. That is, if losses are valued to a lesser degree than gains, one would expect to observe more discounting for losses than for gains. On a more practical level, however, the present results should highlight an important aspect of researching delay discounting. Specifically, one cannot assume that measuring one type of discounting (e.g., discounting of gains) will produce results that generalize to other types of discounting (e.g., discounting of losses).

A good example of that can be observed in Figure 1. Whereas a small, albeit non-statistically significant, magnitude effect (Thaler, 1981) was observed for the discounting of gains, the same manipulation produced the opposite, and significant, change in discounting of losses. This difference may make intuitive sense in that, as potential gains increase in size, they become more valuable and, as potential losses increase in size, they become less valuable. With that said, previous researchers (e.g., Estle et al., 2006) have reported finding reliable magnitude effects for gains but not for losses. Thus, the present results would need to be replicated to determine the reliability of the present findings. However, given the large observed effect sizes (Cohen, 1988), one would predict that they would be. It is also possible that the present results were influenced by the amounts chosen for study. That is, had the differences in magnitudes been larger, a statistically significant magnitude effect for discounting gains may have been observed. Likewise, had the magnitudes tested been smaller, the magnitude effect for the discounting of losses may not have been observed.

Finding that GFA-R subscale scores were only predictive of discounting for one of the four outcomes does not suggest that there is a strong relationship between the contingencies that maintain gambling behavior and the process(es) of discounting. Inasmuch as these results suggest that there is such a disconnection, they question the supposition that the process of discounting is a primary component of problem/pathological gambling.

With that said, gambling for positive and for negative reinforcement were both predictive of delay discounting of losing $1,000. Thus, one cannot claim that such contingencies will never be related to discounting. An intriguing feature of these results was that scores on the two GFA-R subscales were related to discounting in opposing directions. That is, as GFA-R scores for positive reinforcement increased, the less of the hypothetical loss participants were willing to pay immediately rather than waiting. As scores on gambling for negative reinforcement increased, the more of the hypothetical loss participants were willing to pay immediately rather than waiting to pay the full amount. In other words, the higher participants scored on gambling for negative reinforcement, the more likely they were to display a self-control response when discounting losing $1,000.

Assuming this result is reliable, it might seem counter intuitive. That is, if problem/pathological gambling is closely related to gambling as an escape (Miller et al., 2010), and problem/pathological gamblers are more likely to display an impulsive, rather than a self-control, response (e.g., Petry & Madden, 2010), then the present results are the opposite of what one might predict. However, it should again be noted that previous research in this area has focused on discounting of gains. It might be the case that people whose gambling is maintained by negative reinforcement are more prone than those whose gambling is maintained by positive reinforcement to have their behavior altered by delayed aversive events. Losing $1,000 may have been aversive enough to alter their behavior (and/or too small to alter the behavior of those who gamble for positive reinforcement). A similar effect may not have been observed for losing $100,000 because the size of that loss was so substantial that it masked this particular difference. Future research will be needed to determine whether this result is in fact reliable and whether this particular explanation is plausible. The fact that these possibilities remain viable also supports the idea that the GFA-R might be a valuable research tool.

It should be noted that there are a number of issues related to the present study that promote caution if and when attempting to generalize the results. The present sample was comprised of university undergraduates who, on the basis of their self-reported annual income, appeared to be full-time students. These individuals were relatively young, the sample was primarily female, the vast majority of participants were Caucasian, and nearly all were unmarried. Any of these factors may have influenced the results. It is also the case that they were all attending an institution in the upper Midwest of the United States. Replicating the present procedure with a more diverse sample than used in this study would seem warranted.

The present procedure (i.e., the multiple-choice method) was also not the typical procedure used in studies of delay discounting. Research has demonstrated that rates of discounting can vary as a function of method employed to collect the data (e.g., Smith & Hantula, 2008). Thus, it cannot be assumed that similar results would have been observed had a different method been employed.

Lastly, the present study did not target pathological gamblers. Thus, it is not possible to tell whether the present results would be replicated in that population. Given that the GFA-R was intended to be used with people with potential gambling problems, future research should certainly focus on using the GFA-R, and measuring discounting, with this particular population. Only then will we know the usefulness of the GFA-R and its potential relationship to discounting in pathological gamblers.

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APPENDIX

Questions asked in the delay-discounting task. *X time* was 6 months, 1 year, 3 years, 5 years, or 10 years, across questions. Participants selected an answer from 51 potential choices (see the Method section).

<u>Gain $1,000</u>

You own a number of bonds. Your financial advisor tells you that if you wait *X time*, the bonds will be worth $1,000. However, you can cash them in now, although you will not get the full amount. What is the smallest amount of money you would accept today rather than waiting *X time* to get $1,000?

<u>Gain $100,000</u>

You own a number of bonds. Your financial advisor tells you that if you wait *X time*, the bonds will be worth $100,000. However, you can cash them in now, although you will not get the full amount. What is the smallest amount of money you would accept today rather than waiting *X time* to get $100,000?

<u>Lose $1,000</u>

You recently lost money on a bad investment, and in *X time* you will have to pay your broker $1,000. Your broker, however, is willing to make a deal with you to allow you to pay part of what you owe immediately instead of the full amount in *X time*. What is the most money you would be willing to pay immediately rather than waiting to pay the full $1,000?

<u>Lose $100,000</u>

You recently lost money on a bad investment, and in *X time* you will have to pay your broker $100,000. Your broker, however, is willing to make a deal with you to allow you to pay part of what you owe immediately instead of the full amount in *X time*. What is the most money you would be willing to pay immediately rather than waiting to pay the full $100,000?