RATES OF DELAY AND PROBABILITY DISCOUNTING OF NORTHERN PLAINS AMERICAN INDIANS DISCOUNTING INDIAN AND MAJORITY CULTURE-SPECIFIC OUTCOMES

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Abstract: Discounting occurs when the value of an outcome changes because its delivery is delayed or uncertain. Discounting provides insight into how individuals make decisions, with rates of discounting being related to a number of behavioral disorders. In this study, 39 American Indians (AIs), 29 female, were recruited from the psychology department participant pool at a university in the Northern Plains to complete an acculturation inventory and delay- and probability-discounting tasks related to money, health care, and education reform. Results from ANOVAs showed that participants did not differentially discount the delayed outcomes, but discounted the probabilistic monetary outcomes to a greater extent than probabilistic outcomes involving education reform, suggesting that participants were more risk averse with the monetary, than the education, outcomes. Differences in discounting were not observed as a function of whether the outcome would occur on or off a tribal reservation. Results from regression analyses showed that participants' affiliation with the majority culture was also related to how they discounted probabilistic monetary outcomes. The present study represents the first attempt to measure probability discounting in AI participants and is the first to show differences in this type of decision making. The results, therefore, represent a step forward in understanding when risk-averse versus risk-prone decisions (i.e., a small but certain outcome vs. a better but uncertain outcome) may be made, and how those decisions are related to acculturation in AIs.

Discounting refers to the finding that the subjective value of an outcome is altered if its delivery is either delayed or uncertain (i.e., delay or probability discounting, respectively; Madden & Bickel, 2010). For instance, if a person won a sum of money, but could not collect it for a certain amount of time, then s/he would likely be willing to accept a lesser amount to get the money immediately. Research on discounting has shown that, in general, as the full outcome is increasingly delayed or becomes increasingly improbable, a person is willing to accept less of the full amount to get the outcome immediately or with certainty, respectively (see Madden & Bickel, 2010, for a review).

How quickly the subjective value of the delayed or uncertain outcome decreases is known as the "rate" of discounting. Rates of delay discounting can be said to measure a person's tendency toward impulsivity versus self-control. Rates of probability discounting, on the other hand, can be said to measure a person's tendency toward risk aversion versus risk proneness.

Some researchers have argued that these types of discounting are related to one another (e.g., Green & Myerson, 1996; Rachlin, Logue, Gibbon, & Frankel, 1986), as the same mathematical model (i.e., a hyperbolic function; Mazur, 1987) describes well the data from both types of discounting, and some researchers have reported that one can determine a constant for the same outcome when it is either delayed or probabilistic (Rachlin, Raineri, & Cross, 1991; Yi, de la Piedad, & Bickel, 2006). However, others have argued that they are at least somewhat distinct (e.g., Green & Myerson, 2004; Rachlin, Brown, & Cross, 2000; Reynolds, Patak, Shroff, Penfold, Melanko, & Duhig, 2007), for several reasons. For example, the same manipulations (e.g., changing the magnitude of the outcome) can produce different changes in the two types of discounting (e.g., Estle, Green, Myerson, & Holt, 2006), changes in delay alter probability discounting differently than changes in probability alter delay discounting (Weatherly, Petros, Jónsdóttir, Derenne, & Miller, in press), and the two types of discounting appear to activate different neural pathways (Mobini, Chiang, Ho, Bradshaw, & Szabadi, 2000).

Psychologists are interested in how people make decisions about discounting for a number of reasons. Steep rates of delay discounting, and shallow rates of probability discounting, have been associated with psychological disorders (see Odum, 2011b), including substance abuse and dependence (see Yi, Mitchell, & Bickel, 2010) and pathological gambling (see Petry & Madden, 2010). Further, researchers have suggested that the process of discounting may be involved in important individual decision-making situations (e.g., regarding one's own health; see Tucker, Simpson, & Khodneva, 2010) or in policy makers' decisions pertaining to social issues (e.g., Hardisty & Weber, 2009).

There are several other important reasons to study discounting within American Indian (AI) populations. First, some of the disorders that have been associated with both delay and probability discounting are found at higher rates among some AI populations than in the majority population (e.g., McDonald & Chaney, 2003; Wardman, el-Gueblay, & Hodgins, 2001). Understanding discounting within AI populations may help explain why some disorders occur at higher rates, and how to prevent or treat them. For example, if rates of discounting certain outcomes are shown to be predictive of certain disorders (e.g., substance abuse), then educators and counselors can focus their efforts on altering how people make decisions about those outcomes. However, to date, no such studies have examined these possibilities in AI populations.

Second, cultural perspective may influence how people discount certain outcomes. Du, Green, and Myerson (2002) reported differences in how American, Chinese, and Japanese participants discounted delayed and probabilistic hypothetical monetary outcomes. For example, American participants discounted probabilistic rewards most steeply, whereas Chinese participants discounted such rewards the least steeply. Perhaps more relevant to the present study, Weatherly and McDonald (2011) asked Northern Plains AI university students, and a matched sample of Caucasian students, to discount a variety of delayed outcomes. Results demonstrated that differences in discounting were sometimes observed between the groups, with the direction of the difference (i.e., toward impulsivity or self-control) varying as a function of the type of hypothetical outcome being discounted. Studying discounting across different cultures has the potential both to inform us as to the process of discounting and to help identify exactly how similar decisions may be framed within different cultures.

Third, a multicultural perspective may influence how people make decisions about discounting. Most, if not all, AIs are immersed in two different cultures: their traditional tribal/community culture and the majority U.S. culture. However, that fact does not necessarily mean that particular outcomes will be equally valued within both cultures. Research has shown repeatedly that rates of discounting can vary as a function of the magnitude of the outcome (e.g., the larger the monetary amount, the longer people tend to be willing to wait for it; Chapman, 1996; Thaler, 1981) and/or the type of outcome being discounted (e.g., money vs. medical treatment; Weatherly & Terrell, 2011; Weatherly, Terrell, & Derenne, 2010). Thus, one might predict that AIs would display different rates of discounting for different outcomes as a function of the cultural context in which the outcome occurs. One might also predict that this difference would vary as a function of how strongly an AI participant identifies with his/her AI culture and the majority culture.

This last reason also has implications for research on AI mental health issues. For instance, Oetting and Beauvais (1990) theorized that a multicultural orientation can be viewed as orthogonal. That is, it is possible for AIs to be highly competent in both their traditional culture and the majority

culture (bicultural), highly competent in one culture but not the other, or highly competent in neither culture. They argued that being bicultural is associated with good mental health and generally positive social functioning. Subsequent researchers have made a similar argument (e.g., McDonald & Chaney, 2003). Conversely, those AIs who have less competence in both cultural orientations may be at risk for greater psychopathology and lower social functioning. Given that rates of discounting have been associated with a number of psychological disorders (e.g., steep rates of delay discounting and shallow rates of probability discounting have been linked to pathological gambling; Petry & Madden, 2010), one might therefore predict that measures of biculturalism in AI participants would be associated with how those participants discount delayed or uncertain outcomes.

To date, only one study (Weatherly & McDonald, 2011) has investigated discounting in AI participants. However, that study had a fairly small sample of AIs (8 and 18 in two separate groups), and the focus of the study was to compare rates of discounting of the AI participants to those of a matched sample of Caucasian participants. The goal of the present study was to focus solely on discounting behavior of AI participants. Furthermore, Weatherly and McDonald only investigated differences in rates of delay discounting. To date, no published studies have investigated rates of probability discounting in AI participants. Likewise, no study has considered the potential relationship between bicultural orientation and discounting. The present study did so.

Thirty-nine AIs attending a university in the Northern Plains were recruited to participate in the present study. The participants completed several measures: a demographic questionnaire, a bicultural orientation questionnaire, and a two-part discounting task. Appendix A shows the hypothetical items used in the discounting task.

Our hypotheses were as follows. First, because previous research has found that rates of discounting differ as a function of the magnitude (e.g., Estle et al., 2006) and/or type of outcome (e.g., Weatherly et al., 2010), we predicted that different rates of discounting would be observed across the different hypothetical outcomes (e.g., being owed money vs. receiving medical treatment).

Second, we predicted that different rates of discounting would be observed for outcomes within the participants' traditional cultures versus those within the majority culture. Rates of probability discounting increase (i.e., people tend to be willing to accept smaller amounts of the outcome) as the magnitude of the outcome increases (e.g., Estle et al., 2006), and that tribal outcomes would have a greater magnitude than federal outcomes. Therefore, we predicted steeper rates of probability discounting of the tribal education resolutions than the federal education legislation.

Third, we predicted that rates of discounting would be associated with participants' levels of identification with their traditional and the majority cultures (i.e., discounting of tribal vs. federal educational issues would differ as a function of participants' AI cultural identification). Also, consistent with the research that suggests that bicultural identification is associated with better mental

health (e.g., McDonald & Chaney, 2003) and that steep rates of delay discounting and shallow rates of probability discounting are associated with certain psychological disorders (e.g., Petry & Madden, 2010), we predicted that low levels of cultural identification would be associated with such rates.

METHOD

Participants

The study was open to students at the University of North Dakota who were members of federally recognized AI tribes and were enrolled in psychology classes between January 2011 and January 2012. The study was completed using SONA, an online experiment-management system (SONA Systems, Ltd, Version 2.72; Tallinn, Estonia) available only to students enrolled in psychology classes. The study was advertised only within SONA, materials were presented by the system, and all data were collected within this system. SONA tracked participation at the individual level, ensuring that each eligible student could participate only one time.

The original sample consisted of 47 individuals. Data from eight potential participants were discarded because, although they self-identified as AI, they either failed to specify any tribal affiliation or provided an affiliation with a non-federally recognized tribe. Thus, the final sample of participants consisted of 39 (10 male, 29 female) AIs. Participants received extra course credit in their psychology class as compensation.

Materials and Procedure

The first item presented to participants was a description of the study as approved by the Institutional Review Board at the University of North Dakota. Continuation in the study beyond this item constituted the granting of informed consent.

In all, participants completed three measures; the order of presentation varied randomly across participants.

The first measure was a demographic questionnaire which asked participants about AI status and tribal affiliation, age, grade point average, marital status, and participation in tribal activities (e.g., powwows).

The second measure was a 20-item questionnaire based on the Northern Plains Biculturalism Inventory-Revised (NPBI-Revised; Baker, 2005), designed to assess level of biculturalism. Researchers selected 20 items from the NPBI-Revised for use in this study, retaining the original wording. The questions pertained to how much the respondent identified, or felt comfortable, with AI and majority cultural practices. All items were endorsed on a 5-point Likert-like scale; 13

were associated with AI cultural identification (AICI) and 7 with majority, or European American, cultural identification (EACI). Scores for each subscale were calculated by summing the responses across the associated items. Although several measures of biculturalism have been developed and tested (e.g., Moran, Fleming, Somervell, & Manson, 1999), this particular inventory was used because it was developed specifically for AIs of the Northern Plains. Baker (2005) factor analyzed responses from the items in this inventory and reported a two-factor solution that corresponded to the intention behind the inventory. Internal consistency of the inventory in the present study was adequate, with Cronbach's alphas of 0.81 for the entire inventory and 0.91 and 0.76 for the AICI and EACI subscales, respectively.

The third measure was a two-part discounting task. The first part was a delay-discounting task that asked questions about four different hypothetical outcomes (being owed $1,000, being owed $100,000, obtaining medical treatment for oneself, and obtaining medical treatment for one's child). The exact wording of these questions can be found in Appendix A. The monetary outcomes were used because hypothetical monetary sums are the most commonly used outcomes in discounting research (see Madden & Bickel, 2010). Two different monetary sums were included as a manipulation check (i.e., the magnitude effect; Thaler, 1981). Specifically, because people tend to be willing to wait longer for larger outcomes, one would expect rates of delay discounting to be less steep for the $100,000 outcome than for the $1,000 outcome. The medical outcomes were chosen because past research suggests that decisions pertaining to medical treatment may differ from those pertaining to monetary sums (Terrell, Derenne, & Weatherly, in press; Weatherly et al., 2010; Weatherly & Terrell, 2011). The self versus child manipulation was chosen to determine if decision making would differ as a function of who would experience the hypothetical outcome. Furthermore, these outcomes were similar or identical to outcomes used in past research (e.g., Weatherly et al., 2010).

Participants were asked five questions about each delayed outcome, with the difference across questions being the delay to receiving the full outcome. The five delays were 1, 5, 10, 20, or 50 years. These particular delays were used to evaluate whether there might be a difference in time perspectives between AI and majority cultures. By using very long delays, we were attempting to maximize differences in discounting as a function of the participants' cultural identities.

The second part was a probability-discounting task that also asked about four different hypothetical outcomes (winning $1,000, winning $100,000, passing federal education reform legislation, and passing tribal education reform resolutions). The monetary outcomes were chosen for the same reasons described above. The education outcomes were also chosen because research suggests that discounting of these outcomes may differ from discounting of monetary ones (Terrell

et al., in press; Weatherly et al., 2010; Weatherly & Terrell, 2011). The federal versus tribal manipulation was designed to test whether discounting would vary as a function of whether the hypothetical outcome occurred on or off the reservation.

Again, participants were asked five questions about each outcome, with the difference across questions being the probability of receiving the full outcome. The five probabilities were 1, 10, 50, 90, or 99%. The exact wording of each outcome for the probability-discounting tasks can also be found in Appendix A.

In the discounting task, the outcomes were presented serially. That is, participants completed all five questions about one outcome before questions about another outcome were asked. The order of the eight outcomes varied randomly across participants, as did the order of the delays or probabilities for the individual outcomes.

Participants answered each discounting question by selecting from a series of researcher-provided response options, which is a variation of the multiple-choice method introduced by Beck and Triplett (2009). The exact response options for each outcome can also be found in Appendix A. Research on this particular method of collecting discounting data has shown that it produces temporally reliable results for both delay (Beck & Triplett, 2009) and probability (Weatherly & Derenne, in press) discounting. Likewise, research (Weatherly & Derenne, 2011) also suggests that this method typically, but not always, produces rates of discounting that are similar to other brief-response methods of collecting discounting data, such as the fill-in-the-blank method (Chapman, 1996).

Data Preparation and Analysis

The discounting data were analyzed by calculating the area under the discounting curve (AUC; Myerson, Green, & Warusawitharana, 2001) using Equation 1:

$$\sum_{i=1} (x_{i+1} - x_i) \times (y_i + y_{i+1})/2$$

With Equation 1, AUC is calculated by summing the areas of the successive trapezoids created by the indifference points (i.e., the participants' responses) across the five different delays or probabilities. For the delay-discounting outcomes, x was calculated in months. For the probability-discounting outcomes, x was calculated in terms of odds against the outcome. For both types of discounting, AUC values could vary between 0.0 and 1.0, with the value varying inversely with the rate of discounting. That is, a person who is willing to settle for a small amount of an outcome because the full outcome is delayed or uncertain is discounting steeply and therefore will display a discounting curve that has little area under it, which will be represented by a small AUC value. Conversely, a person who expects a large amount of the outcome despite the full outcome being

delayed or uncertain is discounting very little and therefore will display a discounting curve that has a large area under it, which will be represented by a large AUC value. For delay discounting, small AUC values indicate a tendency toward impulsive responding and large AUC values indicate a tendency toward a self-control response. For probability discounting, small AUC values indicate a tendency toward risk aversion and large AUC values indicate a tendency toward risk.

Although other analysis methods are available, we employed Equation 1 for several reasons. First, Equation 1 does not assume that the discounting data will take a certain form across the different delays or probabilities, unlike, for example, being fitted by a hyperbolic function (see Madden & Bickel, 2010, for a review). Second, with Equation 1 (and unlike with other methods), AUC values are calculated directly from the data rather than being estimated from the data. Third, AUC values are typically parametric, and therefore do not require data transformation prior to conducting statistical analyses (see Myerson et al., 2001, for a full discussion of the merits of AUC).

To test for differences in rates of discounting of the different outcomes, two one-way repeated measures analyses of variance (ANOVAs) were conducted, one on the AUC values from the four delayed outcomes and one on the AUC values from the four probabilistic outcomes. These analyses were conducted, rather than a two-way (small/large by money/education) ANOVA because one cannot necessarily equate tribal versus federal education as small versus large. The delayed and probabilistic outcomes were analyzed separately because there was no theoretical reason to believe that the five delays tested perfectly equated to the five probabilities tested. That is, one cannot assume that the delays of 1 or 50 years are the equivalent of having a 99 or 1% chance of receiving the outcome. Tukey HSD post hoc comparisons were made in the event that statistically significant results (i.e., $p \leq .05$) were observed.

To test for an association between cultural identification and rates of discounting, a simultaneous linear regression was conducted on each discounted outcome. In these analyses, the AUC value served as the dependent measure and the participants' scores for AICI and EACI served as predictor variables. Simultaneous regressions were employed because these analyses allowed for a determination of how much variance in the AUC values could be independently accounted for by the AICI and EACI scores.

RESULTS

Participants

All 39 participants self-identified as members of federally recognized AI tribes, with 20 identifying as Chippewa, 9 as Sioux, and the remaining 10 identifying with another Northern Plains tribal affiliation (affiliations were self-reported; i.e., they were not selected from options created

by the researchers). Participants reported a mean age of 24.4 years (*SD* = 8.4 years) and a grade point average of 3.0/4.0 (*SD* = 0.8). Five (12.8%) reported being married and 11 (28.2%) reported having a child. Twelve participants (30.8%) reported that they regularly attended powwows. Two participants (5.1%) reported that they had served on their tribe's tribal council, and nine (23.1%) indicated that someone in their family had served on their tribe's tribal council. The mean score on the AICI subscale of the biculturalism inventory was 37.7 (*SD* = 10.9). The mean score on the EACI subscale was 24.9 (*SD* = 5.2). AICI and EACI scores correlated at $r\,(39) = -0.202$, $p = 0.217$ (two-tailed). Thus, participants' responses averaged in the "neutral" category for both scales.

Delay Discounting

The mean AUC values for being owed $1,000, being owed $100,000, getting medical treatment for a serious disease, and getting medical treatment for one's child for a serious disease were 0.61 (*SD* = 0.32), 0.66 (*SD* = 0.26), 0.67 (*SD* = 0.23), and 0.67 (*SD* = 0.23), respectively. The one-way repeated measures ANOVA indicated that these values did not differ significantly from one another, $F(3, 114) = 0.81$, $p = 0.494$, $\eta^2 = 0.021$.

The first linear regression was conducted on discounting the outcome of being owed $1,000. Again, AUC value served as the dependent measure and the participants' scores for AICI and EACI served as predictor variables The model was not significant, $F(2, 36) = 0.00$, $p = 0.998$, $R^2 = 0.000$, and neither AICI ($\beta = 0.010$, $p = 0.956$) nor EACI scores ($\beta = 0.007$, $p = 0.962$) were significant predictors of discounting.

A similar result was observed for the outcome of being owed $100,000, with the model failing to reach statistical significance, $F(2, 36) = 0.01$, $p = 0.994$, $R^2 = 0.000$, and neither AICI ($\beta = -0.002$, $p = 0.989$) nor EACI scores ($\beta = -0.018$, $p = 0.916$) being significant predictors of discounting.

Likewise, for the outcome of getting medical treatment, the overall model, $F(2, 36) = 0.90$, $p = 0.414$, $R^2 = 0.048$, and both AICI ($\beta = 0.022$, $p = 0.897$) and EACI scores ($\beta = -0.213$, $p = 0.208$) failed to reach statistical significance. When the outcome was one's child receiving medical treatment, the overall model again failed to reach statistical significance, $F(2, 36) = 2.78$, $p = 0.075$, $R^2 = 0.134$. Again, neither AICI ($\beta = 0.187$, $p = 0.244$) nor EACI scores ($\beta = -0.279$, $p = 0.087$) were significant predictors of discounting.

Thus, for the delayed outcomes, different rates of discounting were not observed for the different outcomes. Furthermore, level of identification with either an AI or the majority culture was not predictive of how participants discounted any of the delayed outcomes tested.

Probability Discounting

The mean AUC values for winning $1,000, winning $100,000, federal education legislation, and tribal education resolutions were 0.36 (*SD* = 0.28), 0.34 (*SD* = 0.29), 0.71 (*SD* = 0.23), and 0.69 (*SD* = 0.25), respectively. The one-way repeated measures ANOVA indicated that these values differed significantly from one another, $F(3, 114) = 42.84$, $p < 0.001$, $\eta^2 = 0.530$. Tukey HSD post hoc tests indicated that rates of discounting of the monetary outcomes differed significantly from discounting of the education outcomes. However, the difference in AUC values between the two monetary outcomes and between the two education outcomes was not statistically significant.

The first linear regression was conducted on discounting the outcome of winning $1,000. The model approached statistical significance, $F(2, 36) = 3.02$, $p = 0.061$, $R^2 = 0.144$. Participants' AICI scores were not significant predictors of the AUC values ($\beta = -0.022$, $p = 0.889$). However, EACI scores were significant predictors of discounting ($\beta = -0.383$, $p = 0.020$), with higher EACI scores being predictive of lower AUC values (i.e., risk aversion). A similar result was observed for the outcome of winning $100,000. The model was statistically significant, $F(2, 36) = 4.78$, $p = 0.014$, $R^2 = 0.210$. AICI scores were not significant predictors of discounting winning $100,000 ($\beta = 0.055$, $p = 0.717$), but EACI scores were significant predictors ($\beta = -0.444$, $p = 0.006$). Again, greater identification with the majority culture was associated with steeper rates of probability discounting (i.e., lower AUC values).

The results for the education outcomes were different. When analyzing the AUC values for discounting federal education legislation, neither the overall model, $F(2, 36) = 0.71$, $p = 0.470$, $R^2 = 0.041$, nor the predictor variables, AICI: $\beta = 0.175$, $p = 0.301$ and EACI: $\beta = -0.073$, $p = 0.662$, were significant. Likewise, when analyzing the AUC values for discounting tribal education resolutions, neither the overall model, $F(2, 36) = 0.18$, $p = 0.837$, $R^2 = 0.010$, nor the predictor variables, AICI: $\beta = -0.039$, $p = 0.817$ and EACI: $\beta = -0.099$, $p = 0.562$, were significant.

Thus, for the probabilistic outcomes, different rates of discounting were observed between the monetary and education outcomes. Furthermore, level of identification with the majority culture, but not with an AI culture, was predictive of how participants discounted the monetary outcomes. However, cultural identification was not predictive of how participants discounted the education outcomes.

DISCUSSION

Our first hypothesis was that different rates of discounting would be observed across the different outcomes being discounted. This hypothesis was not supported when participants discounted delayed outcomes, but was supported when they discounted probabilistic outcomes.

Our second hypothesis was that AI participants would discount a majority culture outcome (i.e., federal education legislation) differently than a tribal outcome (i.e., tribal education resolution). This hypothesis was not supported. Finally, we predicted that participants' level of identification with an AI culture and the majority culture would predict how they discounted delayed and probabilistic outcomes. Cultural identity was a significant predictor of discounting for only two of the eight outcomes tested. Perhaps surprisingly, in those instances, it was participants' identification with the majority culture, and not their AI culture, that predicted discounting.

Weatherly and McDonald (2011) reported sometimes finding differences in rates of delay discounting between Northern Plains AI and Caucasian participants. The present study employed only AI participants and did not find differences in rates of delay discounting across four different outcomes. One could argue that the failure to observe differences was due to a small sample size. However, the fact that we found significant differences in discounting across the probabilistic outcomes would seem to counter this argument. This failure to find differences in rates of delay discounting was likely the outcome of a small effect size (Cohen, 1988). That is, the type of delayed outcome being discounted simply did not account for much of the variance in the observed AUC values. It should also be noted that this failure was probably not due to any aberrance in the data. Although the difference was not statistically significant, participants tended to display higher AUC scores for being owed $100,000 than for being owed $1,000, which would be consistent with the magnitude effect (Thaler, 1981).

Theoretically, there are several possible explanations for the failure to find differences in the rates of delay discounting. One is that Northern Plains AIs tend to discount all delayed outcomes similarly. Consistent with this explanation, some researchers have suggested that delay discounting potentially can be viewed as a personality trait (e.g., see Odum, 2011a, b), and, thus, knowing how an individual discounts one outcome would be predictive of how s/he would discount any other outcome. However, the present study only measured two types of delayed outcomes: money (two amounts) and medical treatment (for oneself and for one's child). Additional research on a wider array of delayed outcomes is warranted before one concludes that rates of delay discounting are uniform across outcomes, or are personality traits.

With that said, the results with the probabilistic outcomes suggest that similar rates of discounting will not always be observed. Participants discounted the probabilistic monetary outcomes significantly more than the educational outcomes. Some researchers have argued that the processes of delay and probability discounting are distinct (e.g., Green & Myerson, 2004). Thus, one should not generalize the conclusions from the probabilistic outcomes to delay discounting (or vice

versa). However, given that prior research has found that rates of discounting can vary as a function of the type of delayed outcome being discounted (e.g., Odum & Rainaud, 2003; Weatherly et al., 2010), it is possible that the same finding would ultimately be observed in AI participants as well.

In this study, we found that rates of discounting for the probabilistic monetary outcomes were steeper than those observed for the educational outcomes, which indicates that the participants were more risk averse with the monetary outcomes than with the educational outcomes. This finding does not necessarily mean, however, that participants placed more value on money than on education. Two arguments can be made against this possibility. First, because one might be willing to take a greater risk to get more of an outcome does not logically lead to the conclusion that that outcome is not valuable. In fact, one could argue that the more valuable an outcome, the more risk one would be expected to take to obtain it. Second, although research on probability discounting suggests that rates of discounting vary directly with the magnitude of the outcome (e.g., Estle et al., 2006), research also suggests that there are certain outcomes that participants will not discount very steeply regardless of whether the outcome is delayed or uncertain (see Weatherly & Derenne, 2013). Educational outcomes may fall in that category. What cannot be argued, however, is that the participants made different decisions about the probabilistic monetary and educational outcomes.

Perhaps surprisingly, level of identification with an AI culture did not predict how participants discounted any of the outcomes. The failure to find such a relationship may have been influenced by the fact that all of the participants were attending a non-tribal university and thus were at least partially, if not highly, integrated into the majority culture. One might also argue that all of the outcomes tested could be interpreted from a majority-culture perspective (i.e., the outcomes reflected concerns not specific to an AI culture). A third possibility is that the questionnaire used to assess identification with a Northern Plains AI culture lacked sufficient validity, although this argument can be countered by the fact that the construct validity of the measure has been established (Baker, 2005).

What may be equally surprising is that identification with the majority culture was predictive of how participants discounted probabilistic monetary outcomes. The more participants identified with the majority culture, the more risk averse they were when the outcome was money. Finding that identification with the majority culture was associated with discounting of these outcomes, but not with the discounting of probabilistic education outcomes or of any of the delayed outcomes, suggests that identification with the majority culture could influence specific aspects of decision making. That is, such an identification is associated with decisions about risking money, but not with decisions about waiting for money. This finding requires replication before strong conclusions are drawn from it. However, should the effect prove to be reliable, it would have major theoretical, and perhaps clinical, implications for the interaction between acculturation and decision making.

The present study is the first to report differences in probability discounting in an AI sample of participants, and to find that some discounting was related to identification with the majority culture. However, it also has a number of limitations. First, the present sample consisted only of AIs attending an off-reservation university in a single geographic area, the Northern Plains, and who were all relatively similar in age. Second, AIs in general tend to experience issues such as poverty at higher rates than the majority population, and factors such as socioeconomic status have been shown to be related to how individuals discount (e.g., Stanger et al., 2012). Thus, the rates of discounting observed in the present study may have been influenced by uncontrolled factors.

One could also argue that AIs may differ from other Americans in their views of the federal government and it policies based upon their tribe's history with the government; the present study did not specifically measure or control for this possibility. It is also the case that access to, and quality of, health care might differ across tribes (e.g., Novins, Beals, Sack, & Manson, 2000), which may have influenced how participants responded to the medical treatment discounting questions. Finally, several psychological disorders have been associated with rates of both delay and probability discounting. However, this study did not measure levels of mental health and did not ask if participants had specific disorders. Future researchers may be wise to do so.

These limitations notwithstanding, the present results suggest that AIs in the Northern Plains may make different decisions about probabilistic outcomes as a function of the type of outcome and the level of their affiliation with majority culture. Although strong conclusions should not be drawn from a single study that employed a moderate number of participants from one region of the country, we hope that the results will serve to encourage future research in this area. As noted above, determining when AI participants will make risk-averse versus risk-prone decisions, and how such decisions are associated with acculturation, may advance our understanding of AI populations in a number of positive ways. Future research that investigates these issues in larger, more diverse samples (e.g., age, level of education) that include participants living both on and off reservations would certainly seem warranted.

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Appendix A
Delay and Probability Discounting Questions

Delay Discounting Questions

X time = 1, 5, 10, 20, or 50 years

Owed $1,000

If you were owed $1,000 and were not going to get the money for X time, what is the smallest amount of money you would accept today rather than having to wait X time?

$1,000	$980	$960	$940	$920	$900	$880	$860	$840	$820	$800	$780	$760
$740	$720	$700	$680	$660	$640	$620	$600	$580	$560	$540	$520	$500
$480	$460	$440	$420	$400	$380	$360	$340	$320	$300	$280	$260	$240
$220	$200	$180	$160	$140	$120	$100	$80	$60	$40	$20	$0	

Owed $100,000

If you were owed $100,000 and were not going to get the money for X time, what is the smallest amount of money you would accept today rather than having to wait X time?

$100,000	$98,000	$96,000	$94,000	$92,000	$90,000	$88,000	$86,000	$84,000
$82,000	$80,000	$78,000	$76,000	$74,000	$72,000	$70,000	$68,000	$66,000
$64,000	$62,000	$60,000	$58,000	$56,000	$54,000	$52,000	$50,000	$48,000
$46,000	$44,000	$42,000	$40,000	$38,000	$36,000	$34,000	$32,000	$30,000
$28,000	$26,000	$24,000	$22,000	$20,000	$18,000	$16,000	$14,000	$12,000
$10,000	$8,000	$6,000	$4,000	$2,000	$0			

Medical Treatment - Self

Suppose you were suffering from a serious disease and your physician informed you that you would need to wait X time before getting a treatment that was 100% successful. However, you could immediately begin a different treatment that has a lesser chance of success. What is the minimum percentage of success that the different treatment could have for you to choose it?

100%	98%	96%	94%	92%	90%	88%	86%	84%	82%	80%	78%	76%	74%
72%	70%	68%	66%	64%	62%	60%	58%	56%	54%	52%	50%	48%	46%
44%	42%	40%	38%	36%	34%	32%	30%	28%	26%	24%	22%	20%	18%
16%	14%	12%	10%	8%	6%	4%	2%	0%					

Medical Treatment - Child

Suppose your child was suffering from a serious disease and her physician informed her that she would need to wait X time before getting a treatment that was 100% successful. However, your child could immediately begin a different treatment that has a lesser chance of success. What is the minimum percentage of success that the different treatment could have for you to choose the different treatment for your child?

100%	98%	96%	94%	92%	90%	88%	86%	84%	82%	80%	78%	76%	74%
72%	70%	68%	66%	64%	62%	60%	58%	56%	54%	52%	50%	48%	46%
44%	42%	40%	38%	36%	34%	32%	30%	28%	26%	24%	22%	20%	18%
16%	14%	12%	10%	8%	6%	4%	2%	0%					

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Appendix A, Continued
Delay and Probability Discounting Questions

Probability Discounting Questions

Y% chance = 1, 10, 50, 90, or 99%

Winning $1,000

You are a finalist in a national sweepstakes. You have a Y% chance of winning $1,000. If your number is not called, however, you do not receive anything. The organization running the sweepstakes is willing to guarantee to pay you a certain amount of money if you agree to remove your name from the sweepstakes. What is the smallest amount of money would you be willing to accept rather than having a Y% chance of winning $1,000?

$1,000	$980	$960	$940	$920	$900	$880	$860	$840	$820	$800	$780	$760
$740	$720	$700	$680	$660	$640	$620	$600	$580	$560	$540	$520	$500
$480	$460	$440	$420	$400	$380	$360	$340	$320	$300	$280	$260	$240
$220	$200	$180	$160	$140	$120	$100	$80	$60	$40	$20	$0	

Winning $100,000

You are a finalist in a national sweepstakes. You have a Y% chance of winning $100,000. If your number is not called, however, you do not receive anything. The organization running the sweepstakes is willing to guarantee to pay you a certain amount of money if you agree to remove your name from the sweepstakes. What is the smallest amount of money would you be willing to accept rather than having a Y% chance of winning $100,000?

$100,000	$98,000	$96,000	$94,000	$92,000	$90,000	$88,000	$86,000	$84,000
$82,000	$80,000	$78,000	$76,000	$74,000	$72,000	$70,000	$68,000	$66,000
$64,000	$62,000	$60,000	$58,000	$56,000	$54,000	$52,000	$50,000	$48,000
$46,000	$44,000	$42,000	$40,000	$38,000	$36,000	$34,000	$32,000	$30,000
$28,000	$26,000	$24,000	$22,000	$20,000	$18,000	$16,000	$14,000	$12,000
$10,000	$8,000	$6,000	$4,000	$2,000	$0			

Federal Education Legislation

One bill will be forwarded in this year's Federal legislative session. Your senators are considering two possible bills. The first bill is perfect in that it will address all of the issues that need reforming, but the chance of it passing is Y%. The second bill will not address all of the issues that need reforming, but it is guaranteed to pass. What percentage of perfect (i.e., 100%) would the second bill need to be before you would advise your senators to vote for it rather than having Y% chance that the perfect policy passes?

100%	98%	96%	94%	92%	90%	88%	86%	84%	82%	80%	78%	76%	74%
72%	70%	68%	66%	64%	62%	60%	58%	56%	54%	52%	50%	48%	46%
44%	42%	40%	38%	36%	34%	32%	30%	28%	26%	24%	22%	20%	18%
16%	14%	12%	10%	8%	6%	4%	2%	0%					

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Appendix A, Continued
Delay and Probability Discounting Questions

Probability Discounting Questions
Tribal Education Resolutions
The tribal council of your tribe is considering two resolutions concerning the school system on your reservation. The council members indicate that the first resolution will address all of the issues that need addressing, but the chance of it passing before the next tribal election is Y%. The second resolution will not address all of the issues that need addressing, but it is guaranteed to be approved. What percentage of perfect (i.e., 100%) would the resolution need to be before you would advise the council members to vote for it rather than having Y% chance that the perfect resolution passes?
100% 98% 96% 94% 92% 90% 88% 86% 84% 82% 80% 78% 76% 74%
72% 70% 68% 66% 64% 62% 60% 58% 56% 54% 52% 50% 48% 46%
44% 42% 40% 38% 36% 34% 32% 30% 28% 26% 24% 22% 20% 18%
16% 14% 12% 10% 8% 6% 4% 2% 0%