Evaluating the Iowa Gambling Task as a direct assessment of impulsivity with low-income children ☆

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ABSTRACT

This study examined performance on the Iowa Gambling Task (IGT; Bechara, Damasio, Damasio, & Anderson, 1994) as a measure of low-income school-aged children's affective decision-making and considered its utility as a direct indicator of impulsivity. One hundred and ninety-three 8–11 year olds performed a computerized version of the Iowa Gambling Task, a validated measure of decision-making. Multi-level modeling was used to examine children's performance over the course of the task, with age, gender, and teachers' ratings of child impulsivity (BIS-11; Patton, Stanford, & Barratt, 1995) used to predict children's Iowa Gambling performance. Higher impulsivity scores predicted a decrease in slope of Iowa Gambling performance, indicating students rated higher on impulsivity chose more disadvantageously across the task blocks. Results support evidence of the validity of the Iowa Gambling Task as a measure of impulsivity in low-income minority children.

1. Evaluating the Iowa Gambling Task as a direct assessment of impulsivity with low-income children

Living in poverty is associated with the development of negative behavioral and emotional problems in children (Noble, McCandliss, & Farah, 2007; Takeuchi, Williams, & Adair, 1991). Research has shown that a key individual difference that distinguishes children's likelihood of avoiding costly negative outcomes such as delinquency, substance abuse, and school failure in the face of adversity may be their ability to control their impulses. That is, some low-income children may be at higher risk for experiencing problems in their schools and communities due to problems of behavioral disinhibition, while other children are better able to take advantage of learning opportunities because of higher levels of behavioral and emotional control (Raver et al., 2011). Emerging work in the fields of affective neuroscience and developmental science offer the prospect of a cohesive means by which to study impulse control (defined as inhibiting an automatic response in order to successfully complete a goal) (Bezdjian, Baker, Lozano, & Raine, 2009). Specifically, the Iowa Gambling Task (IGT; Bechara, Damasio, Damasio, & Anderson,

1994) has been viewed by many investigators as an excellent means of tapping "hot cognition" (affective decision-making) and holds potential as a direct assessment measure of impulsivity (Bubier & Drabick, 2008). Yet few studies have used assessments such as the Iowa Gambling Task to examine this key form of self-regulation among samples of low-income children (see Bubier & Drabick, 2008).

In the following study, we aim to address this empirical gap, given clear evidence that the optimal development of impulse control may be jeopardized by environmental stressors associated with chronic poverty (Blair & Raver, 2012; Noble et al., 2007). For example, several studies (de Wit, Flory, Acheson, McCloskey, & Manuck, 2007; Green, Myerson, Lichtman, Rosen, & Fry, 1996; Harrison, Lau, & Williams, 2002) have found lower income to be associated with greater impulsiveness and more delay-discounting, or preferring smaller rewards, sooner, over larger but delayed rewards. The development and validation of direct assessments of impulsiveness for use with children from lower income families may help researchers better understand both the correlates and consequences of individual differences in this key form of self-regulation for children facing economic adversity. In addition, little is known regarding children's performance on the IGT, particularly among samples of children facing higher environmental risk. The following paper seeks to address these questions, by assessing impulsiveness vs. impulse control using multiple methods (including teacher report and performance on the IGT) among a large, ethnic minority, low-income sample of students in urban elementary schools.

1.1. The Iowa Gambling Task

The IGT is a computerized card game commonly used to measure risky decision making tendencies or individuals' sensitivity to reward and loss. As a simulation of real-life decision-making, the IGT involves weighing "expected but uncertain rewards and penalties" (Franken, van Strien, Nijs, & Muris, 2008). Participants must choose from four decks of cards across 50 trials, with the goal of acquiring as much money as possible. Decks C and D consistently provide smaller wins of $50 and also lower levels of net loss over time, making these decks *advantageous*. In comparison, decks A and B consistently give out larger wins of $100 but have substantially higher levels of net loss over time, making these decks *disadvantageous*. Additionally, decks B and C produce more frequent, but smaller losses, while decks A and D produce infrequent but larger losses. Importantly, while rewards remain consistent, losses vary across trials, and the type of loss varies between decks. Analysis of participant choices across trials reveals their tendencies toward risk taking and abilities to weigh future outcomes.

Two types of indices can be calculated that measure participants' (a) tendency to choose advantageously (where the choice of decks is likely to yield smaller rewards for each card drawn, but minimizes larger losses, over time) and their (b) tendency to select from decks that offer infrequent (though larger) loss. The first index, measuring *long-term consequence*, represents this tendency to play for "lower stakes" with the benefit of a more advantageous outcome overall and indicates if a participant understands long-term effects of certain deck-choosing strategies. For this first index, an increase in positive values across the task indicates the participant's preference for "good" decks that promise a smaller gain for each card that is "dealt," but that incrementally lead to greater total gain and lower loss, over time. The second index, a *bias for infrequent loss*, indicates the number of deck choices that lead to infrequent-but-larger losses relative to the number of choices that lead to frequent-but-smaller losses (for this second index, positive scores indicate more infrequent-loss choices) (Hooper, Luciana, Conklin, & Yarger, 2004). Both indices are calculated across five blocks of task trials.

Findings on the IGT long-term consequence index suggest that children may be sensitive to the anticipatory experience of reward, and consequently may be less good at playing the game in terms of avoiding losses (Crone, Jennings, & van der Molen, 2004). In short, children may struggle with a tendency to focus on immediate outcomes rather than future consequences (Hooper et al., 2004; Overman, 2004). This is in keeping with the landmark hypothesis proposed by (Damasio, Tranel, and Damasio, 1991), that the prospect of winning (or losing) a large sum of money can serve as a "primary inducer," whereby a somatic state of pleasure (at the possibility of winning) or discomfort (at the prospect of losing) may non-consciously drive decision-making. While healthy adults and adolescents tend to learn to choose advantageously across the task (Overman, 2004; Sweitzer, Allen, & Kaut, 2008; Upton, Bishara, Ahn, & Stout, 2011), some research has shown that younger children tend to select disadvantageously (Blair, Colledge, & Mitchell, 2001; Hooper et al., 2004; Huizenga, Crone, & Jansen, 2007). One notable exception is a study of 8-year-olds employing a 280-trial child version of the IGT in which children learned to choose advantageously in later task blocks (Carlson, Zayas, & Guthormsen, 2009). Children also tend to have a bias for larger, infrequent-loss decks on the IGT, preferring those decks to the decks that provide smaller, but more frequent losses (Carlson et al., 2009; Hooper et al., 2004; Huizenga et al., 2007). The majority of studies that have examined gender differences on the IGT among children or adolescents have found no differences between boys and girls (e.g. Carlson et al., 2009; Hooper et al., 2004). Generally, these studies have taken place in laboratory settings where the strengths of high precision in measurement and experimental control have been balanced against constraints such as limited generalizability to broader samples or other populations (Enticott, Ogloff, & Bradshaw, 2006).

In stark contrast, large scale survey studies on risky behavior in American youth have tried to address empirical questions regarding individuals' predispositions towards impulsive or risky behavior, by using parent- and teacher report. One strength of that measurement approach is that it can easily be deployed in large school- and community-based studies. However, this approach lacks precision relative to direct assessments such as the IGT, and may also suffer from reporter bias or lack objectivity (Arnold & Feldman, 1981; Kroes, Veerman, & De Bruyn, 2003). One of the benefits of the IGT is that it offers a more empirically precise "lens" into processes of decision-making in the contexts of reward and loss, and as a direct assessment of child skill, may be more "objective" than teacher- or parent-report measures. In this study, we examine whether the IGT may provide a promising resolution to some of these concerns.

In sum, the following study examines ways that the IGT, developed as a measure of decision-making in adults, may offer promise for the assessment of affective decision-making among low-income, ethnic minority children, serving as a valid means of measuring impulsivity directly in field-based settings. Accordingly, this study aims to address the following questions:

1. How do low-income children perform on the IGT administered in a field-based setting?
2. Is IGT performance related to teachers' ratings of child impulsivity, after adjusting for age and gender?

Consistent with previous research demonstrating that children have difficulty weighing future outcomes of decks' various reward *and* loss intervals (Crone et al., 2004; Hooper et al., 2004; Overman, 2004), we predict that children in this sample will choose in ways that highlight their somatic preferences for immediate reward but that may lead to disadvantageous long term outcome across the IGT. Further, we expect children will have a strong preference for infrequent-loss decks over frequent-loss decks, as found in prior studies. We base this hypothesis on the possibility that children may focus on the frequency of the loss as the most salient feature of the task. In so doing, children may have a more difficult time with mastering a key cognitive demand of IGT, namely that winning involves attending to two dimensions, rather than a single dimension of the task (e.g. both the loss's frequency and the magnitude; Huizenga et al., 2007). Finally, we predict that higher teacher-rated impulsivity scores will be associated with lower long-term consequence scores, or more disadvantageous choices, across the IGT. We base this prediction on our theory that the IGT can serve as a valid direct measure of impulsivity among this sample, and thus should be related to teachers' subjective reports of child impulsivity (assessed with the BIS, a well-known measure of impulsivity).

2. Method

2.1. Sample

Data for this study comes from the Chicago School Readiness Project (CSRP), a socioemotional intervention trial implemented in preschool programs located in high-poverty Chicago neighborhoods. The current study sample consists of 193 children who took part in a follow-up wave of data collection. Assessors administered the IGT to individual students in Chicago Public Schools using laptop computers. The majority of participants were African–Ameri-