Who do you listen to? The effects of perceived gender on decision making

Senior Research Thesis

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by

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Abstract

Previous research indicates heuristics, presented as visual cues (e.g., spiders/butterflies, Republican/Democrat), can alter decision-making on the Iowa Gambling Task (IGT). Implicit bias, an automatic categorization process, can affect women, who may experience discrimination and prejudicially-fueled behaviors towards them. Implicit biases can impact decision making, but to date, no research has examined if gender can be used as a heuristic in risky decision making. I hypothesized that performance on the IGT could be impacted by the color of the card decks, using pink to activate implicit biases about women and blue to activate implicit biases about men. Additionally, I hypothesized an interaction between the IGT condition and participant gender. In Study 1, participants were 334 Mechanical Turk (MTurk) workers randomly assigned to complete one of three IGTs: (1) pink-Decks C+D, blue-Decks A+B; (2) blue-Decks C+D, pink-Decks A+B; or (3) the standard IGT. Results provided no evidence that the color of the IGT decks impacted decisions. However, when examining the individual deck selections, it is likely that participant gender had some impact on decision making. In Study 2, participants were 710 MTurk workers randomly assigned to complete one of the same IGT versions as Study 1, but with an implicit association test (IAT) used to activate potential gender-based biases. When using the traditional IGT scoring, there was little support for implicit gender biases affecting decisions. However, the pattern of individual deck selections indicated an in-group bias: women tended to select from the pink decks when they were advantageous and men tended to select from the blue decks when they were advantageous. Overall, the present studies provide mixed support for gender as a heuristic on the IGT, as additional research is needed to tease apart the influence of the individual-deck differences on subsequent decisions.

Who do you listen to? The effects of perceived gender on decision making

Implicit bias, an automatic process that changes how we interact with other people that is often based on stereotypes and prejudice, can negatively affect women, as it creates unconscious associations that propel discriminatory behaviors towards them. When individuals are making decisions under ambiguity, Type I decision making may come into play in that they make quick decisions that rely more on gut feelings and emotions than on deliberative processes. Heuristics, or cognitive ‘short-cuts,’ can affect Type I decision making processes. The present study seeks to examine if gender and implicit gender biases serve as heuristics in this decision-making context utilizing the Iowa Gambling Task (IGT) as the specific decision making task. These and other concepts will be further defined in the remaining sections. Terminology regarding gender and sex have changed significantly across time. In the remainder of the literature review,Iutilize the terminology specific to each referenced study. For the present study itself, I use gender to refer to a socially constructed category and sex to refer to biological sex assigned at birth.

Categorization and Implicit Bias

From a young age, one begins to take in information from the world around them—finding patterns and connections in order to learn how the world works. One process by which the brain learns about the world around it is through categorization (Reisber, 2022). Categorization occurs when the brain takes a given stimulus (e.g., an object) and assigns it to one or more groups based on specific characteristics or features that it has. For example, a child may categorize all four-legged animals as dogs. But over time, they may learn to further differentiate this category based on other characteristics such as the sound an animal makes: “meow” is a cat, “bark” is a dog, etc. These experiences enable the individual to create better mental groupings of these animals, allowing for easier identification in the future. Those animals that remain part of the dog group, for example, have more elements in common than animals in another group, such as cats. This process of categorization can occur for objects, animals, places, people, and more. But for people in particular, categorization may not always be accurate, potentially leading to biases that can be based, at least in part, on social constructs.

Information in the environment around us can help us categorize new information, but it can also lead to potentially inaccurate socially constructed biases and stereotypes (Jackson et al., 2013). Our understanding of the world depends at least in part on the experiences we have with different socially-constructed categories in our cultures. One such prevalent construct is gender (Burns, 2018). Specifically, gender can be cultivated by the culture one lives in, whereas sex is frequently determined by biological characteristics (e.g., primary and secondary sex characteristics). While there are a multitude of different gender identities, the dominant culture of a particular country may categorize individuals according to a binary system that mimics biological sex, using socialization to instill ideologies about these constructed gender identities. In the United States (US), for instance, the prevailing cultural categorization of gender is dichotomous, with individuals categorized into "women," who should act "feminine" by raising a family, and "men," who should instead act "masculine" by serving as the primary income source. These socially constructed gender roles are then learned through observation and feedback received from others (Cacioppo & Freberg, 2013), perpetuating structural biases in favor of those who follow these roles and against those who do not fit these roles. For instance, research suggests that men who hold occupations perceived as feminine, such as nursing, often experience more harassment and social rejection than women in these same occupations (Cherry & Deaux, 1978). However, men in 'feminine' professions still experience a "glass elevator" leading them to rise to leadership positions at faster rates than women (Brandford & Brandford-

Stevenson, 2021). Greater or lesser societal emphasis on these gender roles may also affect our perceptions of who we should listen to or follow. For example, if we only see men in leadership positions at our workplace or in our various levels of systems (e.g., local, state, and national organizations), we may begin to believe that only men can be leaders and internalize bias against the idea of women in leadership positions. If instead we see women in leadership and faculty positions, biases against women in positions of power may be reduced (Dasgupta & Asqari, 2004).

The patterns formulated through categorization that can serve as cues, or short cuts, to enable the brain to make inferences or judgements based on previous knowledge of the categorized groups is referred to as 'heuristics' (Busemeyer & Townsend, 1993; Payne et al., 1988). Heuristics can be beneficial to decision making due to their cognitive cost-savings: they require less cognitive effort, in turn making the perception of given stimuli (or the decision) easier and faster (e.g., more efficient). However, heuristics do not always lead to the most accurate perception of the stimuli. In some cases, they can instead lead to cognitive biases, or errors in judgement that can occur consciously or unconsciously (Simon et al., 2000). Implicit bias, a type of cognitive bias, serves as a mechanism to formulate cognitive associations which allow for the recall of one's memory to shape a mental pattern (Bellezza & Bower, 1981). Implicit bias is an automatic response that can occur outside of conscious awareness (Greenwald et al., 1998). Social constructs that are learned through observation, coupled with one's own experiences in life (i.e., the area or culture one grew up in), can directly influence the creation of implicit biases for or against different social groups (Barreto et al., 2003; Handley et al., 2015). Some of the most common implicit biases focus on age, ethnicity and/or perceived immigration status, sexual orientation, and gender. Implicit age biases can even lead individuals to believe older adults are less competent than younger adults. For example, Syme and Cohn (2020) found evidence of implicit age bias in a mock jury study, as jurors were less likely to find an individual guilty of sexual assault if they were perceived as being elderly.

Implicit race bias may also lead individuals to act in ways that discriminate against a member of a specific race. For instance, someone with implicit biases against African Americans tends to rate individuals as less trustworthy (Stanley et al., 2011), resulting in participants giving less money to those who were perceived as African American compared to those who were perceived as Caucasian. Implicit race bias can also lead to difficulties with face processing, such as having lower recognition of faces outside of compared to within one's own race (Trawiński et al., 2021). This bias can also lead to appearance stigma, a type of stigma towards individuals whose appearance deviates from those of the cultural norm or beauty standard (Rudman & McLean, 2015). Clark and Clark (1939) found appearance stigma to even manifest in ingroups. Specifically, African American children would rate perceived Caucasian appearing dolls as "pretty" and perceived African American appearing dolls as "ugly," leading to a preference for the Caucasian appearing dolls. These implicit biases can also affect perceptions of an individual's immigration status. Research suggests that one's national identity can install implicit biases towards out group members, or toward those perceived to be from another country (Bauer & Hannover, 2020). It is suggested that this bias is what fuels hostility towards immigrants and anti-immigration stances.

Implicit biases are also held against those who identify as a part of the LGBTQIA+ community. For example, gay job applicants were rated more negatively and were less likely to be hired for a job than nongay applicants (Nadler et al., 2014). Additionally, volunteer callers who were not members of the LGBTQIA+ community were more effective in collecting donations for marriage equality than callers who identified as a member of the LGBTQ+ community (Harrison & Michelson, 2012).

Implicit bias also may lead to microaggressions, or exclusionary behaviors which imply hostility towards marginalized groups, towards transgender students in the form of cisgender bias, structural oppression, and social exclusion (Austin et al., 2019). Microaggressions have also leaked into the workplace. For example, women are often left out of important conversations and decisions made in the workplace (Suskind, 2011). For example, a recent *Chronicle of Higher Education* (2022) publication provided a case example of an African American woman serving as a provost at a predominantly white institution. Despite having 21 years of experience in higher education and administration, she continued to experience microaggressions such as colleagues undermining the decisions she makes and comparing them to how others—commonly white men--would have addressed them. Microaggressions can transpire in a multitude of ways; however, they all have one common denominator – implicit bias.

Collectively, implicit bias exists and is likely related at least in part to the natural process of categorization learned in childhood. Sometimes this process creates a shortcut—a heuristic—that can decrease cognitive processing needed when making a decision, but in some cases, the process may lead to an implicit bias. In the next section, I focus on implicit gender bias and how it can affect real-world factors and decisions.

Implicit Gender Bias

Implicit biases can lead to hardships for women in the work force. Even though increasing numbers of women are pursuing higher education, they continue to face inequities in the workplace such as lower pay and organizational rankings (Aud et al., 2011). According to the U.S. Census, for every dollar a man makes, a woman, on average only makes 82 cents (2020). In academia specifically, a 2023 report found of all full-time faculty, only 48.2% are women (Ameircan Association of University Professors, 2023). This same report found that across all academic faculty levels, on average, a woman earns 82 cents for every 1 dollar a man in a comparable position makes. This gender pay gap was the greatest for full-time faculty, where women, on average, made a salary of $136,490, compared to the average man making $156,820. Additionally, 58% of academic department heads are male, and 85% are white (The Chronicle of Higher Education, 2022). It is important to note that campuses should have diverse staff; otherwise, students who do not see faculty of similar backgrounds will feel as if they are an outgroup member and do not belong in academic settings.

Implicit associations between gender and STEM may account for some of the pay inequities and other difficulties women experience in these fields (Jackson et al., 2013). When given the choice between a physician with a stereotypical female and one with a stereotypical male name, with all other factors held constant, individuals preferred the perceived male physician. Men are also more likely seen as physicians and women as nurses (Boge et al., 2019), making it less likely that women physicians are recognized in their occupations (Prince et al., 2006). While there appears to be no gender preferences in female-dominated and integrated occupations, there is a continued preference for men over women in male-dominated jobs (Koch et al., 2014). For instance, law enforcement careers tend to be male-dominated. While male police officers deny any gender inequity, female police officers not only recount multiple occurrences of gender inequity but also found mechanisms to help adapt to it (Murray, 2021). Implicit gender biases carry over to leadership positions as well, as women are perceived as less influential, competent, and rational when holding leadership in a group (Carli, 1999).

The negative perception of women leaders can lead to a preference—implicit or explicit—for men to be leaders and women to be followers (Braun, 2016). Often times, the words commonly associated with leadership can run counter to words used to describe the female gender construct (e.g., leaders [and males] are "aggressive" but females *should* be "gentle"). The favoritism for males over females in leadership positions leads to the consequence of the underrepresentation of women in leadership positions. Studies have also found that varying the name of an applicant between male and female, with no other differences, prompts different callback rates for interviews (Chang et al., 2020). In order for a woman to compete with men in masculine-typed domains, she must provide strong, counter-stereotyped evidence that she is competent. Research has even found that the same emotional response in a male and female leader can have different impacts on one's ability to influence others in decision making processes (Salerno et al., 2015). Specifically, anger seems to be effective when men, but not women, use it to persuade others. This finding may be due to implicit biases which prompt different gender-based heuristics, leading to an angry female being perceived as less valid or effective than an angry male. Implicit biases have also impacted decision making regarding the hiring process, as hiring and promotional decisions, often in male-dominated fields, are typically biased against women (Keck et al., 2019). Other emotions that are typically perceived of as feminine, such as sadness, are only viewed of as appropriate for men when they are in a masculine setting (e.g., a man crying during a sports game; MacArthur, 2019). For example, recently, the Buffalo Bills safety, Damar Hamlin, went into cardiac arrest during a football game versus the Cincinnati Bengals (Bolte, 2023). The male football players, as well as the male fans, reacted to this event by displaying their intense emotions of sadness – something that is perceived as non-masculine in most contexts. However, because this occurred in a masculine setting, men were allowed to convey their emotions about this traumatic event and even praised for it. This effect also carries over to perceiving sadness as more acceptable in men with masculine occupations (e.g., a firefighter) than feminine occupations (e.g., a nurse).

In sum, implicit gender bias not only exists, but has real-world implications which can impact career trajectories for both men and women. Implicit gender bias can also be quantified and measured; therefore, it can vary in strength and magnitude (e.g., strong/weak, positive/negative for one gender). This can be evident in the tools in which researchers utilize to measure implicit bias, which will be discussed in the next section.

Measuring Implicit Bias

One way implicit bias can be measured is with the Implicit Association Test (IAT). The IAT is built on automatic cognitive associations which shape one's implicit biases (Greenwald, et al., 1998). On the IAT, individuals categorize words into categories appearing either on the left or right of the screen. There are typically four categories of words, two of which are paired on one side of the screen. Individuals are faster and more accurate when making pairings which are already matched in their cognition, or pre-existing heuristic (Greenwald et al., 1998). For example, the initial IAT had participants match bug, flower, pleasant, and unpleasant words. Matches were quicker and more accurate when the pleasant and flower words shared the same side of the screen and slower when they were on opposite sides. Per the task creators, this finding was congruent with the heuristic that flowers were pleasant and bugs were unpleasant.

The IAT has since been adapted to different sociocultural identities, such as race, and to the extent of attitude change over time (e.g., Greenwald et al., 1998; Halberstadt et al., 2022). For example, Meister and colleagues (2015) utilized a rubber hand experiment in which Caucasian participants first completed a version of the IAT assessing implicit racial bias. Then, participants had one of their hands hidden from them and replaced by the sight of a hand with either a Caucasian skin tone or an African American skin tone. They then created the rubber hand illusion by touching both the rubber hand and real hand simultaneously, leading the brain to believe both hands were the participants due to multisensory processing. Participants then completed the IAT a second time, with results indicating changes in IAT scores based on the rubber hand condition. Specifically, Caucasian participants who had an African American rubber hand demonstrated decreased implicit bias towards African Americans compared to those who had a Caucasian rubber hand. The IAT has been used to find correlates in the differential empathic activation for race (Berlingeri et al., 2016). Specifically, Caucasian participants were asked to empathize with actors of varying races, Caucasian or African American, as they were touched by either a needle or rubber eraser. Participants were asked to determine how much pain they believed the actor to be in. Results indicated that the magnitude for perceived pain was the same regardless of race, but participants were significantly faster when determining the pain levels for Caucasian actors than for African American actors. This effect was positively correlated with racial biases measured through the IAT. This finding may allude to implicit racial bias clouding the ability to empathize with others depending on their race, illustrating how implicit racial biases can formulate prejudices which, unconsciously, impact the ways in which one interacts with individuals who they perceive as belonging to a marginalized group.

The IAT can also be adapted to assess the extent of gender-based bias. Across several IAT versions, research indicates faster and more accurate responses when females are matched with language arts and males with science (Zitelny et al., 2017); males with successful manager traits and females with unsuccessful traits (Latu et al., 2011); and female gender with less power and male gender with more power (Haines & Kray, 2005). These findings are representative of multiple ways in which implicit gender bias can manifest itself. Essentially, it is suggested that people tend to more easily categorize women with terms evoking less power and more follower positions; likewise, men are equated with power and leadership positions. Additionally, this research could allude that implicit gender biases formulate prejudices against women in leadership positions whom hold power since individuals tend to categorize women as not having such.

Through the utilization of fMRI techniques, research has also found correlations between a version of the IAT that measured implicit bias surrounding the self and death and activity in the prefrontal cortex (Ballard et al., 2019). However, for the most part, completion of the IAT is mostly correlated with activation in the amygdala (e.g., Chekround et al., 2014; Phelps et al., 2003; Cunningham et al., 2004). Although the amygdala is commonly linked with emotional activation (Gazzaniga et al., 2018), it is also associated with decision making in ambiguous and risky situations. For example, individuals with temporal lobe epilepsy, who have seizures originating in the amygdala, tend to make riskier decisions on the Iowa Gambling Task (IGT), a task measuring risky decision making (Delazer et al., 2010). Worse performance on the IGT has also been correlated with damage to the amygdala (Manes et al., 2002). Additionally, individuals with temporal lobe epilepsy are more likely to develop gambling disorders due to the inability to accurately assess risk (Cavanna et al., 2008). Given that amygdala activation is correlated with both decision making and implicit bias, it is possible that these two processes could be linked. Specifically, it could be that implicit biases are potentially utilized, as heuristics, in risky decision making. In short, implicit bias could be a heuristic that guides decision making by activating emotions – positive or negative – to change decisions.

Implicit Bias and Decision Making

Decision making is the choosing between a multitude of options to determine which provides the most benefit. Sometimes, decisions can be made with little ambiguity, or in which the individual knows how the results of a decision will impact them. On the other hand, other decisions are more ambiguous and carry more risk. Decisions, despite being risky or not, can be made through one of two pathways. The first pathway is Type I (or "hot") decision making (Kahneman, 2010). This form of decision making is quick and relies on heuristic cues, emotions, and gut feelings. Type I decision making is also implicit as it occurs automatically, with little to no cognitive effort. Type II decision making requires more cognitive effort and occurs consciously, with deliberation and reasoning, and is less influenced by heuristic cues. Heuristic cues serve as shortcuts in decision making as they decrease the number of cognitive resources required to come to a decision (Simon, 1955). Essentially, they are rules which one follows to make decisions. However, these rules are subject to biases which can ultimately impact the quality of one's decision making (Kahneman & Tversky, 1973). Type I decision making is more reliant on heuristics as it utilizes them to make quicker decisions (Busemeyer & Townsend, 1993; Payne et al., 1988). Implicit biases also occur unconsciously and rely on little cognitive effort as it is an automatic process (Greenwald et al., 1998). Therefore, it is likely that both of these unconscious cognitive processes can factor into situations where there is ambiguity – thus restricting one's ability to rely on cognitive processes that depend on conscious cognitive effort.

Damage to the orbitofrontal cortex, a region of the prefrontal cortex, can cause impairments in decision making under ambiguity and risk (Damasio, 1994; Damasio et al., 1991; Eslinger & Damasio, 1985). Despite displaying real-world decision making impairments, patients with orbitofrontal cortex damage scored in the average range or higher on standard measures of executive function, or higher order cognitive abilities mediated by the brain's frontal lobe (Lezak et al., 2004). This finding prompted the creation of a task that could identify these real-world decision making impairments in a lab-based setting: the Iowa Gambling Task (IGT; Bechara et al., 1994). On the IGT, participants are presented with four decks or cards, with no other information about the cards other their deck label (A,B,C,D), that they will always win some money but might also lose some money, and that some decks are better than others. Participants make 100 selections from the four decks. Decks A and B, despite always giving participants a win of $100, result in large immediate losses that lead to an overall net loss. Decks C and D, despite giving a consistent win of $50, result in small immediate losses that lead to an overall net gain. In order for participants to earn the most profit on the task, they must learn from post-selection feedback and apply it to their subsequent decisions. Essentially, making advantageous decisions on the tasks requires participants to learn from feedback on each trial, shifting their decisions away from the disadvantageous decks (A+B) with high immediate wins but long term losses and towards the advantageous decks (C+D) with low immediate wins but long-term gains (Bechara et al., 1994; Bechara, 2007). In other words, participants must learn to ignore their Type I decision making instinct to choose from the decks with high immediate rewards and instead pay attention to their learned Type II decision to choose from the decks with low immediate rewards.

The standard IGT is frequently analyzed by assessing performance across five blocks, each consisting of 20 trials (e.g., Bechara, 2007; Bechara et al., 2001). Performance is further broken down based on earlier and later trials (Brand et al., 2007). In the first two blocks, or 40 trials, participants are utilizing Type I decision making due to a high level of ambiguity from the lack information about each deck of cards. However, as participants progress on the task, they begin to learn which cards are advantageous through trial-and-error feedback. By Block 3, participants begin to convert over to Type II decision making, as the feedback obtained from the previous trials has lowered the level of ambiguity around deck selections. As the task progresses, participants should begin to make informed deck selections based on the understanding of the pros and cons of each deck.

The IGT has also been adapted for use in different experimental settings. For example, providing additional information at the start of the task (e.g., Hawthorne et al., 2011) led to changes in the overall decision-making strategy likely by quickly transitioning participants from Type I to Type II decision making earlier. Changing the appearance of the card decks negatively affects decision making. Pittig and colleagues (2014a, 2014b) adapted the IGT for use on a touch-screen monitor, and changed the decks so that two had images of spiders and two had images of butterflies. The image order was randomized such that for some participants the spiders were on the advantageous decks and for others the spiders were on the disadvantageous decks. Participants with arachnophobia avoided the decks with the spider on them, even if it meant their decision making was impaired (e.g., led to long-term losses). In other words, participants relied on their previous heuristic or bias against spiders, leading to negative decision outcomes. More recently, Swigger and colleagues (2022) utilized this paradigm to assess political bias, finding that self-identified Democrats made worse decisions on the IGT when a Republican label was placed on the advantageous decks (and vice versa for Republicans). Therefore, the IGT can be directly manipulated to examine the heuristics one uses to make decisions, and how these heuristics can lead to biases that impact one’s ability to complete the task with the most success. It is possible that gender may be another such heuristic, in that participants may rely on subtle or subconscious gender-based cues (implicit biases) to guide their decisions.

Factors that may also vary one's ability to make decisions may also be internal. Differences in the way males and females make decisions have also emerged out of decision making research. On the IGT, women are more likely to pick from disadvantageous decks – specifically Deck B (Bryne et al., 2016). This is because women may use a different strategy to complete the task then men do by focusing on minimizing the frequency of immediate losses. It is likely that women use the frequency of gains and losses strategy because they are more focused on recent events rather than large infrequent losses. Research has also found that women are more sensitive to losses than wins on the IGT (Garrido-Chaves et al., 2020). Gender-based differences can be seen on other decision making tasks as well. For instance, on the Balloon Analogue Risk Task (BART), men make riskier decisions than women (Gowen et al., 2019). Previous research found that stereotype threats can impact females' ability to complete the IGT to the best of their ability (Vilanueca-Moya et al., 2021). However, little research to my knowledge has determined how implicit gender biases impact one's ability to complete the IGT to their fullest potential. Even feedback prior to decision making tasks can impede one's performance – even if it is not true. For example, a previous lab study we conducted gave participants false feedback about their personality in regard to narcissism. Those who were told they were higher in narcissism made riskier self-other decisions on tasks which required cooperation with another player in order to maximize their profit, and riskier decisions on tasks which only impacted themselves. Even though the feedback given to the participant was not true, they reacted as if it was, leading to differences in how they made decisions.

The Present Study

Implicit biases have been found to impact the decisions one makes in regard to how they impact others of a particular social identity (e.g., Syme & Cohn, 2020; Stanley et al., 2011;

Salerno et al., 2015). Previous research also suggests that women face challenges, which derive from these implicit biases, while in positions of leadership as well as an undermined validity when making decisions for a group (Carli, 1999; Salerno et al., 2015). Previous research has analyzed implicit gender bias in the context of decisions (Moss-Racusin et al, 2012). Specifically, researchers have found that when science faculty are presented with two applicants' resumes, who only differ by name, one will be more likely to accept the one with the perceived male name over the perceived female name. Additionally, they are also more likely to give the perceived male applicant a higher starting salary and more career mentoring. However, little research has been conducted to analyze the impact which gender, as a heuristic, can have on risky decision making.

In the present study, I aim to gain a better understanding of this topic through the utilization of the IGT. Similar to previous IGT research, I altered the deck images of the IGT cards to cue gender heuristics. In Study 1, I altered the colors of the decks to be pink and blue, randomizing the color associated with the advantageous decks (Figure 1). I hypothesized that performance on the IGT would be affected by the color of decks. Specifically, I hypothesized more advantageous performance on the IGT would be found when the advantageous decks (C+D) were blue instead of pink. I also examined whether this effect interacted with participants' self-reported gender. In Study 2, I utilized the same modified IGT but first had participants complete a gender-based IAT in order to prime a) thoughts about gender and b) potential implicit gender biases. I hypothesized that performance on a gender-based IAT—that is, the presence of higher versus lower implicit gender biases—will be correlated with performance on an IGT with gender-specific visuals on each deck. In particular, participants with higher implicit biases will show worse performance on the IGT when the pink (or female) cards are advantageous than when the blue (or male) cards are advantageous.

Study 1: Method

Participants

An a priori power analysis was conducted to determine the required sample size to detect a small-moderate effect. Holding alpha to .05 and power to .90, at least 372 participants were needed for the repeated measures ANOVA. A total of 423 participants were recruited from Amazon's Mechanical Turk (MTurk), an online crowdsourcing research platform, to take part in the study; however, participants were excluded from the remaining analyses for several reasons. Exclusion criteria consisted of the following: previous experience with the IGT (n=24), missing data (n=25), self-reported diagnosis of traumatic brain injury with loss of consciousness over 30 minutes or a substance use disorder (n=23), self-reported colorblindness (n=5), reporting significant distraction during the study (n=1), reporting others influenced their responses (n=3), or a combination of these factors (n=8). The exclusion criteria resulted in 334 remaining participants (M_{age}=41.3$\pm$13.5; 41.4% Male; 77.2% White or Caucasian, 12.6% Black or African American).

Measures

Rosenberg Self Esteem Scale (RSES). The RSES (Appendix A) is a measurement of self-esteem, consisting of ten statements (e.g., I feel that I'm a person of worth, at least on equal basis with others) with 5-point Likert scales in which participants indicate their agreement (1= strong disagreement – 5= strong agreement; Rosenberg, 1965). The RSES is a Guttman scale; therefore, low self-esteem is correspondent with agreeance on items 2,5,6,8,9, and it is correspondent with disagreeableness on items 1,3,4,7,10. The RSES is scored, after reverse coding the agreement items, by totaling the values of each response. The lower the score, the lower the self-esteem. The RSES has a .92 Guttman scale coefficient of reproducibility – indicating that it has high reliability. It also correlates well with other self-esteem measures – indicating that it is a valid scale of self-esteem. Additionally, the internal consistency for the RSES was strong (α=.937).

Big-Five Personality Inventory 2-Extra Short Form (BFI-2-XS). The BFI-2-XS (Appendix B) is a 15-item measurement of personality (Soto & John, 2017). Each item consists of a statement to which one responds to on a scale of 1= disagree strongly through 5= agree strongly. The BFI-2-XS measures 5 different characteristics of personality: open mindedness (e.g., "Is original, comes up with new ideas"), conscientiousness (e.g., "Is reliable, can always be counted on"), extraversion (e.g., "Is dominant, acts as a leader"), agreeableness (e.g., "Is compassionate, has a soft heart"), and neuroticism (e.g., "Worries a lot"). Total scores are compiled for each personality trait. The higher the score, the more prevalent the trait is in one's personality. The BFI-2-XS has alpha reliabilities over .8 across the 5 subscales – indicating that it is a reliable measure. The internal consistencey was moderate for each subscale (αs= .579-.778)

Iowa Gambling Task (IGT). Participants completed one of the three versions of the computerized IGT (Appendix C; Bechara, 2007; Bechara et al., 1994). Participants start the task with a sum of $2,000. The only information they receive about the task is to maximize their earnings by selecting a series of 100 cards from four potential decks: A, B, C, D (see Figure 2). Deck A has immediate gains of $100 and losses from $150-$300 in 50% of selections—resulting in long-term negative net outcomes. Deck B has immediate gains of $100 and losses of $1250 in 10% of selections—also resulting in long-term negative net outcomes. Deck C has immediate gains of $50 and losses of $50 in 50% of selections—resulting in positive long-term net gains. Deck D has immediate gains of $50 and losses of $250 in 50% of selections—resulting in long-term positive net gains. Two decision making strategies are noted in the research to date. In one, participants select the 'advantageous' Decks C and D due to their long-term positive outcomes (Bechara, 2007). In the other, participants instead minimize the frequency of losses through Decks B and D selections (Lin et al., 2007). Participants complete 100 trials, and are provided with a tally that keeps track of how many deck selections they have made (Brand et al., 2007). The 100 trials are broken up into 5 blocks – each consisting of 20 trials. In blocks 1 and 2, participants are making decisions based on high levels of ambiguity; however, as the task progresses into block 3, participants learn which decks are 'advantageous' and 'disadvantageous', in the context of the strategy they are utilizing, through feedback acquired through their previous deck selections.

Procedures

The present study was approved by the university's Institutional Review Board. Information about the study was posted on the MTurk website, where participants could review a brief description before deciding to click through to the consent form. After indicating consent to participate in the study, participants completed the RSES and BFI-2-XS in a counter-balanced order. I utilized a between-participants design, such that after the completion of the RSES and BFI, participants were randomly assigned to one of three IGT conditions: (1) pink-Decks C+D, blue-Decks A+B (*n*=112); (2) blue-Decks C+D, pink-Decks A+B (*n*=125); or (3) the standard IGT (*n*=97) (see Figure 1).

Data Analysis

Given that I was assessing perceived gender as a heuristic affecting decision making, I utilized participants' self-reported current gender/gender identity in the remaining analyses. Since so few participants identified as transgender, genderqueer, or other identity, I limit analyses to just those participants self-reporting a current gender identity of male/man or female/woman. To assess whether the deck type manipulation affected IGT scores, I assessed differences in total net scores, collapsed across all 100 trials, in a 2 (participant gender) x 3 (IGT type) ANOVA. Next, I utilized a 2 (participant gender) X 3 (IGT type) X 5 (IGT block) ANOVA to assess if participants who completed an IGT where the pink (or "female") cards were advantageous had different scores than participants who completed an IGT where the blue (or "male") cards were advantageous. Additionally, I assessed IGT performance in two ways: following the standard net score approach and assessing total selections from each individual deck. Prior to any analyses, I assessed for group-based differences in scores on the RSES and BFI-2-XS, as these control measures may also be related to performance on the IGT. No group differences emerged on the RSES, $F(2,324) = 1.51$, $p = .212$, or any of the Big 5 indices, Fs < 1.91, ps > .150, so these were not included as covariates in the remaining analyses.

Study 1: Results

Group Differences in Total Net Score

First, I assessed overall group differences in IGT scores. A 2 (participant gender) x 3 (IGT type) ANOVA comparing the pink-good, blue-good, and standard versions on the IGT on total net scores indicated no difference in the overall pattern of selections across groups based on group assignment, $F(2,322) = 0.23$, $p = .798$, $\eta_p^2 = 0.001$, nor on gender, $F(1,322) = 3.68$, $p = .056$, $\eta_p^2 = .011$. The interaction was also not significant, $F(2,322) = 0.02$, $p = .983$, $\eta_p^2 = .000$.

Although there were no gender or IGT type differences in total net scores, collapsed across all 100 trials, the main effect of gender fell just outside the traditional range of significance.

Group Differences in Selections Across Blocks and Decks

Next I assessed potential group differences across the five, 20-card blocks of IGT trials. Specifically, I conducted a 3 (IGT type) x 5 (IGT block) ANOVA to assess how the IGT condition may have affected decisions on the IGT. Analyses revealed a significant main effect for block, $F(3.40,1105.58) = 30.37$, $p < .001$, $\eta_p^2 = .085$. Tukey post-hoc tests indicated that, collapsed across IGT type, performance on block 1 ($M = -3.38$; $SD = 8.73$) was significantly worse than performance on blocks 3 ($M = -1.02$; $SD = 11.16$), 4 ($M = 0.11$; $SD = 12.01$), and 5 ($M = 2.10$; $SD = 12.25$), ps<.001. I also found that block 2 ($M = -3.88$; $SD = 10.05$) was significantly different from blocks 3, 4, and 5, ps<.001. Block 3 indicated significantly worse performance than blocks 4 and 5, ps<.001. In other words, across conditions, participants learned to decide more advantageously as the task progressed. Results did not indicate a significant main effect for IGT type, $F(2,325) = 0.14$, $p =.879$, $\eta_p^2 = 0.001$, or significant interaction between IGT type and IGT block, $F(6.80,1105.58) = 0.63$, $p =.728$, $\eta_p^2 = .004$.

To determine if participant gender interacted with the study manipulation to influence IGT performance, I conducted a 2 (participant gender) x 3 (IGT type) x 5 (IGT block) ANOVA. Once again, I found a main effect for IGT block, $F(3.40, 1093.38) = 30.16$, $p < .001$, $\eta_p^2 = .086$, but no main effect for IGT type, $F(2,322) = 0.23$, $p =.798$, $\eta_p^2 = 0.001$, or for gender, $F(1,322) = 3.68$, $p =.056$, $\eta_p^2 = 0.011$. In addition, there were no significant interactions between: (a) IGT type and IGT blocks, $F(6.79,1093.38) = 0.62$, $p =.731$, $\eta_p^2 = 0.004$; (b) gender and IGT blocks, $F(3.40,1093.38) = 0.89$, $p =.454$, $\eta_p^2 = 0.003$; (c) gender and IGT type, $F(2,322) = 0.017$, $p =.983$, $\eta_p^2 = 0.000$; or (d) between gender, IGT type, and IGT blocks, $F(6.79,1093.38) = 1.21$, p

= .294, η_p^2 = 0.007. Based on these findings, it is possible that participants were not primed sufficiently to think about gender when making deck selections on the IGT.

Previous research gives weight to the fact that not all decks are treated the same, and participants may make selections based off alternative strategies (e.g., Lin et al., 2007). Therefore, I next ran a series of 2 (participant gender) x 3 (IGT type) ANOVAs on the total number of selections from each individual deck (A,B,C,D) as the outcome variables (see Figure 3). For Deck A, there was no significant main effect for gender, $F(1,319) = 2.66$, $p = .104$, η_p^2 = 0.008, nor for IGT type, $F(2,319) = 0.76$, $p = .469$, η_p^2 = 0.005. There was also no significant interaction between gender and IGT type, $F(2,319) = 0.04$, $p = .957$, η_p^2 = 0.000. For Deck B selections, I found a significant main effect for gender such that women (*M* = 43.36; *SD* = 19.89) selected more from Deck B than men (*M* = 37.42; *SD* = 21.57), $F(1,319) = 6.75$, $p = .010$, η_p^2 = 0.021. There was not a significant main effect of IGT type, $F(2,319) = 0.38$, $p = .682$, η_p^2 = 0.002, nor interaction between gender and IGT type, $F(2,319) = 0.01$, $p = .986$, η_p^2 = 0.000. For Deck C, I found a significant main effect for gender such that men (*M* = 26.62; *SD* = 22.36) selected from Deck C more frequently than women (*M* = 22.31; *SD* = 17.40), $F(1,319) = 4.72$, $p = .031$, η_p^2 = 0.015. However, there was neither a main effect of IGT type, $F(2,319) = 1.03$, $p = .360$, η_p^2 = 0.006, nor significant interaction, $F(2,319) = 1.03$, $p = .359$, η_p^2 = 0.006. Finally, the 2 x 3 ANOVA on Deck D selections found no significant main effect for gender, $F(1,319)$ = 0.01, $p = .934$, η_p^2 = 0.000, or IGT type, $F(2,319) = 0.39$, $p = .679$, η_p^2 = 0.002. Additionally, no significant interaction effect was found, $F(2,319) = 1.53$, $p = .219$, η_p^2 = 0.009. Based on the pattern of Deck B and Deck C selections, it is possible that the frequency of wins/losses decision-making strategy interacted with the study manipulation, leading to mixed findings when collapsing across decks based on the long-term outcome scoring approach.

Study 1: Discussion

Data collection for Study 1 transpired during the summer of 2022, immediately following Dobbs' decision to overturn Roe V. Wade – which made gender equity a prominent issue. Overall, the present findings did not fully support the hypotheses. There was no evidence that the color of the IGT decks led to significant changes in decision making on the task; however, there are several potential reasons for these findings. It is possible that the manipulation was not successful and did not prime gender the way I intended it to. Although I selected light pink and light blue colors, which are traditionally associated with baby gender in the United States, there was no pre-task information to lead participants to think about gender and to interpret the colors in this way. Adding a gender-based prime prior to the IGT may help magnify the color of the decks in subsequent decision making.

Analyzing the findings based on the individual deck selections, instead of by the traditional/standard long-term outcomes scoring approach, indicated participant gender may have played a larger role than anticipated. Men selected from Deck C at higher rates than women, whereas women selected from Deck B at higher rates than men. This finding is consistent with previous research that found males and females utilized different strategies on the IGT, focusing on long-term outcomes (males) versus frequency of losses (females) (see van den Bos et al., 2013, for review). The study manipulation was created based on the standard scoring approach, grouping Decks A and B together and Decks C and D together. This grouping—the traditional interpretation of the IGT—fits in with the noted decision-making strategy for men, but not women, in the present study. If the gender prime was not strong enough, as is likely, it would not be able to overpower the use of these base-level strategies while completing the IGT.

In the second study, I addressed one of these two limitations. Specifically, I added a gender-based priming prior to the start of the IGT. Participants completed an Implicit Association Task (IAT) based on gender biases/stereotypes, then were randomly assigned to one of the same IGT types as in Study 1. I again hypothesized that more advantageous performance on the IGT would be found when the advantageous decks were blue instead of pink. I also examined whether this effect interacted with participants' self-reported gender.

Study 2: Method

Participants

A priori analysis was conducted to determine the required sample size to detect a small-moderate effect. Holding alpha to .05 and power to .90, at least 432 participants were needed for the repeated measures ANOVA. A total of 818 participants were recruited from Amazon's Mechanical Turk (MTurk) to take part in the study; however, participants were excluded from the remaining analyses for several reasons. Exclusion criteria consisted of the following: previous experience with the IGT (n=30), missing data (n=30), self-reported diagnosis of TBI with loss of consciousness over 30 minutes or a substance use disorder (n=35), self-reported colorblindness (n=4), reporting others influenced their responses (n=2), or more than one of these reasons (n=7). Additionally, participants who completed Study 1 were prohibited from completing Study 2. The exclusion criteria resulted in 710 remaining participants (M_{age} =37.7±12.2; 36.2% Male; 73.5% White/Caucasian, 14.4% Black/African American, 10.4% Hispanic/Latinx).

Measures

In addition to the tasks described in Study 1, the Implicit Association Test (IAT; Greenwald et al., 1998) was administered.

Implicit Association Test (IAT). The IAT is a task where participants group words into their proper categories, which are displayed on either the left or right side of the screen (Appendix D; Greenwald et al., 1998). Participants are given practice rounds where they sort words through two different subcategories of the category, and then a subsequent practice round where they sort words through two more different subcategories of a different category (see Figure 3). For example, participants might see the word “Love” which needs to be correctly sorted into “Pleasant” instead of “Unpleasant,” then they might see “Rose” which needs to be correctly sorted into “Flower” and “Roach” into “Insect.” After learning these associations, participants then sort all the words into the four subcategories at the same time, with two subcategories on each side of the screen (e.g., “Pleasant” and “Flowers” on the same side). After that, the sides alternate, and the previous unmatched subcategories are matched to the same side (e.g., “Pleasant” and “Insect” are now on the same side). Individuals are faster and more accurate when making pairings to subcategories which are already matched in their cognition (Greenwald et al., 1998).

We utilized four different gender versions of the IAT, as it was unclear whether a particular gender pairing would differentially affect IGT performance as each could pull for more positive versus more negative gender biases. On the career version, male (“Ben”) and female (“Rebecca”) words were categorized along with career (“Salary”) and family (“Parents”) words (Nosek et al., 2002). The good/bad IAT version had participants sort male (“Man”) and female (“Woman”) words along with good (“Joyful”) and bad (“Painful”) words. On the science version, participants sorted female (“Girl”) and male (“Boy”) words versus science (“Engineering”) and language arts (“Literature”) words (Nosek et al., 2002).

In a previous pilot study, I also collected words to create a decision making IAT version. I selected words to represent the decision making category that had the strongest gender biases – which was determined by the descriptive statistical frequencies of each word. I had created two subcategories: supervisor and subordinate. The subordinate words consisted of the following: compliant, follower, helpful, communal, dependent, and emotional. The supervisor words consisted of the following: dominant, boss, management, decisive, assertive, and leader. These were then paired with male ("Ben") and female ("Woman") categories.

Procedures

The present study was approved by the university's Institutional Review Board. This study followed the same procedures as Study 1; however, participants also completed the Implicit Association task (IAT). At the beginning of the study, participants completed the RSES and BFI-XSF in a randomized order. For the RSES, internal consistency was strong (α=.926). Internal consistency for the BFI-XSF was moderate for each subscale (αs=.518-.774). Participants were then assigned to one of four IAT conditions: (1) gender and career (n=180) (2) gender good and bad (n=164) (3) gender and decision making (n=173) (4) gender and science (n=193). Additionally, participants were randomized to either receive feedback (n=237) or no feedback (n=473) on their IAT performance (see appendix D) and completed the IAT before (n=461) or after the IGT (n=249). Finally, participants completed one of the three versions of the IGT: (1) pink-good and blue-bad (n=223), (2) blue-good and pink-bad (n=174), or (3) standard (n=223).

Data Analysis

The analyses largely followed the same procedure as in Study 1. Again, I had a relatively small number of participants (n=18) identity as transgender, genderqueer, or other identity, so I limited the analyses to just those participants who self-reported a current gender identity of male/man or female/woman. I then assessed the influence of IAT order, IAT feedback, IAT type, and participant gender identity on IGT scores, in order to determine which factors could be collapsed across in the remaining analyses. First, I assessed differences in total net scores, collapsed across all 100 IGT trials, before assessing decisions by 20-card blocks of trials and by individual deck selections. Prior to any analyses, I assessed for group-based differences in scores on the RSES and BFI-2-XS, as these control measures may also be related to performance on the IGT. No group differences emerged on the RSES, $F(2,685) = 0.57$, $p = .565$, or any of the Big 5 indices, Fs < 1.12, ps > .290, so these were not included as covariates in the remaining analyses.

Study 2: Results

Assessing the Influence of IAT Order and Feedback

First, I ran a series of statistical analyses to assess if the order the IAT was completed in related to participant IGT performance. No significant differences were found in IGT total net scores between participants completing the IAT first and participants completing the IAT last, $t(686) = 0.41$, p=.681, Cohen's d=.033. A 2 (IAT order) x 5 (IGT block) mixed ANOVA also found no significant main effect for IAT order, $F(1, 686) = 0.17$, p=.681, $\eta_p^2 = .000$. I also found no significant interaction between block and IAT order, $F(3.55, 2432.19) = 0.99$, p=..408, $\eta_p^2 = .001$. The order of the IAT did not influence IGT scores, possibly indicating it failed to prime participants when it occurred before the IGT.

Next, I assessed the potential influence of IAT feedback on participant performance on the IGT. No significant differences were found between receiving no feedback or receiving feedback on subsequent IGT performance, $t(686)$=1.02, p=.306, d =.083. A 2 (IAT feedback) x 5 (IGT block) ANOVA also found no significant main effect for IAT feedback, $F(1,686)$=1.05,

p=.306, η_p^2 =.002. I also found no significant interaction between IGT block and IAT feedback, F(3.54,2429.38)=0.35, p=.819, η_p^2 =.001. To further confirm that the IAT feedback type and the IAT order did not influence IGT scores, I conducted a 2 (IAT feedback) x 2 (IAT order) x 5 (IGT block) ANOVA. Analyses yielded no significant interaction between IAT order and feedback type on IGT scores, F(1,684)=0.39, p=.533, η_p^2 =.001. Therefore, it is unlikely that the feedback type has any impact on IGT performance. Given these insignificant findings, I decided to collapse across IAT order and feedback type on subsequent analyses.

Assessing Influence of IAT Type

Next, I ran a series of analyses to determine if the specific IAT condition had a priming impact on IGT performance. I ran a one-way ANOVA with IAT type as the 4-level factor, and IGT total net score as the outcome variable. There was not a significant main effect for IAT type on total net score, F(3,684)=1.567, p=.196, η_p^2 = .007). Assessing the potential interaction between IAT type and IGT blocks, I also conducted a 4 x 5 ANOVA. There was not a significant interaction between IAT type and IGT block, F(10.63, 2423.47)=0.81, p=.626, η_p^2 = .004. Although these findings were not statistically significant, I report the remaining analyses with and without IAT type included as a variable. As some of the IATs primed participants to think about gender in a different direction than others (e.g., good/bad versus science), I felt it important to fully assess the relationship between the presented IAT and decision making. I present the results with and without IAT type included in the model.

Group Differences in Total Net Score

To assess the study hypotheses, I first examined potential group differences in total IGT net scores. A 2 (participant gender) x 3 (IGT type) ANOVA comparing the pink-good, blue-good, and standard versions of the IGT indicated no difference in the overall pattern of selections across groups based on group assignment, $F(2,682) = 0.28$, $p = .759$, $\eta_p^2 = .001$, nor on gender, $F(1,682) = 0.77$, $p = .380$, $\eta_p^2 = .001$. The interaction was also not significant, $F(2,682) = 1.68$, $p = .187$, $\eta_p^2 = .005$. Overall, the study manipulation did not significantly alter the overall pattern of deck selections on the IGT.

Group Differences in Selections Across Blocks and Decks

Next, I assessed potential group differences across the five, 20-card blocks of IGT trials. After first collapsing across IAT order, IAT feedback type, and IAT type, I conducted a 2 (participant gender) x 3 (IGT type) x 5 (IGT block) ANOVA. I found a significant main effect for block, such that as the task progressed, participants learned to select more from the advantageous decks and less from the disadvantageous decks, $F(3.55,2417.47)=56.90$, $p<.001$, $\eta_p^2 = .077$. I found no main effect for gender, $F(1,682)=0.77$, $p=.380$, $\eta_p^2 =.001$. Additionally, I found no main effect for IGT type, $F(2,682)=0.28$, $p=.759$, $\eta_p^2 = .001$. I found no significant interaction between gender and IGT type, $F(2,682)=1.68$, $p=.187$, $\eta_p^2 = .005$, nor between block and IGT type, $F(7.09,2417.47) = 0.87$, $p = .529$, $\eta_p^2 = .003$, or block and gender, $F(3.55, 2417.47) = 2.05$, $p = .094$, $\eta_p^2 = .003$. Additionally, there was no significant interaction between block, IGT type, and gender, $F(7.09, 2417.47) = 0.37$, $p = .922$, $\eta_p^2 =.001$. Adding IAT type to the analysis resulted in no changes to the above pattern of findings; however, the IGT type x IAT type x IGT block interaction approached significance, $F(21.51,2380.86) = 1.54$, $p=.053$, $\eta_p^2 =.014$. The remaining main and interaction effects were not significant.

Just as in Study 1, I next ran a series of ANOVAs to assess potential differences across individual deck selections. First, I ran a 2 (participant gender) x 3 (IGT type) ANOVA with total deck A selections as the outcome variable. I did not find a significant main effect for IGT condition, $F(2,682) = 2.21$, $p=.110$, $\eta_p^2 = .006$. In addition, the analysis revealed no statistically significant main effect of gender, $F(1,682) = 1.09$, $p = .297$, $\eta_p^2 = .002$. Additionally, there was no significant interaction between IGT condition and gender, $F(2,682) = 1.56$, $p=.212$, $\eta_p^2 = .005$. For total deck B selection, I found no significant main effect of IGT condition, $F(2,682) = 0.95$, $p = .386$, $\eta_p^2 = .003$. The analysis also revealed no statistically significant main effect of gender, $F(1,682) = 0.26$, $p = .611$, $\eta_p^2 = .000$. There was also no significant interaction between gender and IGT type, $F(2,682) = 1.98$, $p = .139$, $\eta_p^2 = .006$.

For total deck C selections, I found a significant main effect for IGT condition, $F(2,682) = 4.73$, $p = .009$, $\eta_p^2 = .014$. Tukey post-hoc analyses found that there were less deck C selections on the standard IGT ($M = 19.63$, $SD = 18.21$) than both the pink-good ($M = 24.64$; $SD = 18.51$; $p = .005$) and blue-good ($M = 25.73$, $SD = 19.32$; $p = .016$) conditions. There was not a statistically significant difference between the deck C selections by the pink-good and blue-good groups, $p = .935$. I found no significant main effect of gender, $F(1,682) = 0.41$, $p = .525$, $\eta_p^2 = .001$. The interaction between IGT condition and gender was just outside the traditional realm of significance, $F(2,682) = 2.969$, $p=.052$, $\eta_p^2 = .009$. I examined this interaction for exploratory purposes. Among participants identifying as men, there were no differences in deck C selections across conditions, *p*s > .192. Among participants identifying as women, significantly greater deck C selections were made in the pink-good ($M = 23.91$, $SD = 17.88$; $p = .003$) and blue-good ($M = 27.24$, $SD = 20.96$; $p < .001$) conditions than in the standard IGT ($M = 17.71$, $SD = 14.87$). No differences were seen in deck C selections across the two gender-based IGT conditions, $p = .125$.

Lastly, I found a statistically significant main effect for IGT condition on deck D selections, $F(2,682) = 8.21$, $p < .001$, $\eta_p^2 = .024$. Tukey post-hoc tests indicated that the standard IGT ($M = 28.50$, $SD = 17.29$) had more deck D selections than both pink-good ($M = 23.13$, $SD =$

16.52; $p < .001$) and blue-good ($M = 22.58$, $SD = 17.08$; $p = .008$) conditions; however, pink-good and blue-good were not significantly different from one another, $p = .397$. I found no main effect for gender, $F(1,682) = 0.11$, $p = .743$, $\eta_p^2 = .000$; however, analysis revealed a significant interaction between gender and IGT condition, $F(2,682) = 5.18$, $p = .006$, $\eta_p^2 = .015$. Within the pink-good condition, women ($M = 24.51$, $SD = 16.42$) selected more from deck D than men ($M = 19.85$, $SD = 16.38$), $p = .029$, whereas within the blue-good condition, men ($M = 26.89$, $SD = 22.31$) selected more from deck D than women ($M = 20.41$, $SD = 13.31$), $p = .018$. No differences were seen in deck D selections in the standard IGT, $p = .845$. Additionally, men selected *less* from deck D in the pink-good IGT compared to the standard, $p = .001$, and blue-good, $p = .014$, IGTs. Women, on the other hand, selected *more* from deck D in the standard IGT compared to the pink-good, $p = .025$, and blue-good, $p < .001$, IGTs, as well as in the pink-good compared to blue-good IGT, $p = .037$.

General Discussion

The way in which individuals seek to gain understanding about the world is through the process of categorization (Reisber, 2022). However, categorization has been found to be fundamentally flawed as it is not always accurate and can lead to bias. These biases have the potential to leak into social constructs and may form one's socially constructed biases and stereotypes. Essentially, these patterns serve as cues which advocate for the brain to create heuristics (Busemeyer & Townsend, 1993; Payne et al., 1988). While heuristics can be beneficial in Type 1 decision making – as they lessen the required mental capacity required to make a decision – they still have their impediments. Implicit biases can allude to the hardships that women face in the workforce (Aud et al., 2011). This negative perception of women in masculine settings – that conflict with their femineity – can even impact women in leadership as there is a preference for women to be followers and men to be leaders (Braun, 2016). This leads to the possibility that implicit biases could be used as heuristics to aid in the decision-making process. Research has since found the use of heuristics to manipulate decision making (e.g., Pittig et al., 2014a, 2014b; Swigger et al., 2022). I hypothesized that decision making would be worse in the versions of the IGT when the pink colored decks are 'advantageous,' in comparison to when the blue colored decks are 'advantageous,' under the traditional scoring context (i.e., [C+D] – [A+B]). I also hypothesized that IGT performance could interact with participant gender. In Study 2, I used the IAT to prime participants to think about gender; therefore, I hypothesized this prime would work to strengthen the effects of the deck manipulation.

Overall, the pattern of findings was mixed. Across both studies, I found that decision making improved across the IGT blocks regardless of study condition, a consistent finding from the previous research literature that suggests learning occurs as the task progresses (e.g., Brand et al., 2007). Additionally, both studies suggested that men made more advantageous deck selections than women when the traditional scoring approach was implemented. In Study 1 specifically, I found that men made marginally more advantageous decisions than women on the total net score; however, in Study 2, I found differing patterns of decision making based on participant gender and study condition (see below). The previous research literature suggests a split in how men and women make decisions on the IGT. When utilizing the standard scoring approach, which emphasizes long-term outcomes, men make more advantageous decisions than women. When instead focusing on minimizing the frequency of losses, which the IGT creator called a 'second best' strategy (Bechara, 2007), women make more advantageous decisions than men (e.g., Brynn, 2016). Although finding such between-gender differences was not the intent of the present study, these results do further the IGT research literature suggesting there are two competing decision-making strategies, at times employed differently by men and women, that can lead to inaccurate diagnoses of decision making impairment if not considered in clinical evaluations.

Unfortunately, neither study indicated significant differences across gender-based versions of the IGT through the usage of traditional scoring. After finding no significant manipulation-based differences in Study 1, I hypothesized that the study manipulation was not strong enough to lead participants to think of pink and blue as indicators of gender. I then added a gender-based priming (the IAT) for Study 2, but again there were no significant differences in task performance when using the standard scoring approach. However, Study 2 suggests that gender-based priming has an impact on the pattern of deck selections as participants differed in their deck selections (see upcoming paragraph). Therefore, utilizing traditional scoring yielded mixed support for the hypotheses – such that the IGT paradigm did not work as hypothesized. Specifically, deck color did not seem to impact the decision-making process across trials – which runs counter to previous research that has found gender to be a heuristic in decision making and that heuristics can affect decision making on the IGT (e.g., Pittig et al., 2014a, 2014b; Salerno et al., 2015; Stanley et al., 2011; Swigger et al., 2022; Syme & Cohn, 2020).

Given that previous research has found there to be competing strategies on the IGT (e.g., Bryne et al., 2016), I decided to run analyses based on individual deck selections. Overall, I found there to be differences across gender and IGT condition on the overall frequency of deck selections. In Study 1, I found a main effect of gender in that women participants selected more from Deck B and less from Deck C than men participants, consistent with the minimizing loss frequency strategy. In Study 2, I found an interaction between participant gender and study manipulation that may point towards the deck colors affecting decision making. Selections from

Deck D, the universally-accepted best deck due to both the low frequency of losses and long-term gains (Bechara, 2007), varied by gender and study condition. When the pink decks were advantageous (i.e., Decks C and D), women selected more from Deck D than men. When the blue decks were instead advantageous, men selected more from Deck D than women. In addition, men selected more from Deck D in the standard and blue-good versions of the IGT than the pink-good version, and women selected more from Deck D in the standard and pink-good versions of the IGT than the blue-good version. Collectively, this finding indicates that participants were selecting more from Deck D when it color matched their own gender identity. The prominent Deck B phenomenon may be affecting the overall effect of the gender based IGT, but the use of gender as a heuristic is evident when the decks are examined individually.

Overall, these findings may point toward situational risky decision making in real-world contexts. Despite Deck D being the 'optimal deck' to choose from, I still found several participants limited their total Deck D selections when the deck color did not match their own gender. The idea of an 'optimal' deck may be represented as a choice that seem to be the optimal decision (i.e., lower frequency of losses and long-term gains); however, when using gender as a heuristic in these situations, it clouds the optimality of Deck D. In real-world situations, for example, a man may note a decision as optimal, but not choose it because it was suggested by a woman supervisor. Even more so, this phenomenon could be one of many reasons as to why there are less women in STEM, and other male-dominated jobs, than men. Specifically, maybe women see STEM as an 'optimal' career path for themselves, but since it was traditionally associated with men, they discredit this option and choose a career path that better aligns with their gender role. A reason for these gender-based differences could be due to individuals having an in-group bias towards their own gender. Previous research demonstrates people are positively biased towards their ingroup and negatively biased towards the outgroup (Brown, 2020). Therefore, on top of implicit gender bias, individuals may hold additional positive biases towards those whom they perceive as identifying as the same gender, or ingroup; ultimately, this could cause for individuals to make decisions in support of their gender ingroup – despite the decision not necessarily being the most 'optimal'. This can be potentially exemplified in Study 2 when individuals were more likely to select deck D when it matched their own gender. Therefore, since Deck D has attributes that signify to a participants ingroup, they may view the deck more positively, and be more likely to select it. In real world contexts, maybe one is more likely to listen to advice regarding a decision if they view their superior as a part of their gender ingroup than if they viewed them as a member of their gender outgroup. Therefore, as supported by Study 2, implicit biases have the potential to seep into risky decision making – proposing the potential to be applied to real-world contexts.

Limitations

There are several limitations that may have affected the study findings. First, the IGT is complex, and the prominent Deck B phenomenon interacted with the study manipulation in unanticipated ways. In a future study, it may be helpful to split the gender-prime across Decks A/C and Decks B/D to see if it increases the effect of the study manipulation. Additionally, I incorporated a lot of conditions to help us plan out future studies that are out of the scope of the present series of studies (e.g., different IAT manipulations, the timing of the IAT, presence/absence of IAT feedback), yet lowered the number of participants in each study condition. In the future, researchers should utilize different decision-making tasks, with fewer study conditions, to better assess how gender functions as a heuristic in risky decision making. Another limitation to the study is that although I utilized participant self-reported gender identity in the analyses, very few participants reported an identity outside of man/male or woman/female. It is unclear to what extent cultural norms regarding gender identity might have affected participants in the present study, and a follow-up study with sufficient gender-diverse participants may help shed light on this.

Conclusions

Overall, I found not only mixed support for the hypotheses – that gender can serve as a heuristic on the IGT - but I also provided further evidence that the way the IGT is scored (i.e., the decision-making strategy that is prioritized) matters. Relying on the standard scoring approach, the gender-based manipulation did not appear to alter decision making on the IGT. However, when assessing the decks individually, I did find that the gender-based manipulation, accompanied by the Study 2 priming, did have an impact on decision making. This indicates that the use of decision-making strategies was likely more ingrained and stronger than the study manipulation. If research consistently finds evidence that the frequency-based decision making strategy is gaining ground across men and women, the 'standard scoring' for the IGT should be revised so that decision making impairment is not incorrectly diagnosed. Additionally, this leads to the possibility for the interpretation of the IGT results to be done so incorrectly. The use of competing strategies also makes the creation of paradigms difficult on the IGT – and under values the validity and reciprocity of previous studies that have use traditional scoring mechanisms to assess heuristics on the IGT.

The findings seemed to allude to a possibility that gender may serve as a heuristic in decision making in some capacity. It is a possibility that this heuristic is driven by in-group gender biases that prompt individuals to favor decisions that have embedded cues, perpetrated by gender, even when these decisions are not the most optimal. This could be detrimental to the success of women in occupations which are powered by “old boys’ clubs.” The old boys’ club is a metaphor which is used to describe the phenomena where men who work in a particular domain collectively promote and gain through their in-group; therefore, giving men an unfair advantage, compare to women, to gain leadership and power within the work force (Raghubir & Valenzuela, 2010). In conclusion, if an in-group gender bias can function in real-world contexts, similar to the one uncovered in the present study, this brings about the likelihood for promotional and leadership decisions to favor men over women in a workforce plagued by the old boys’ club.

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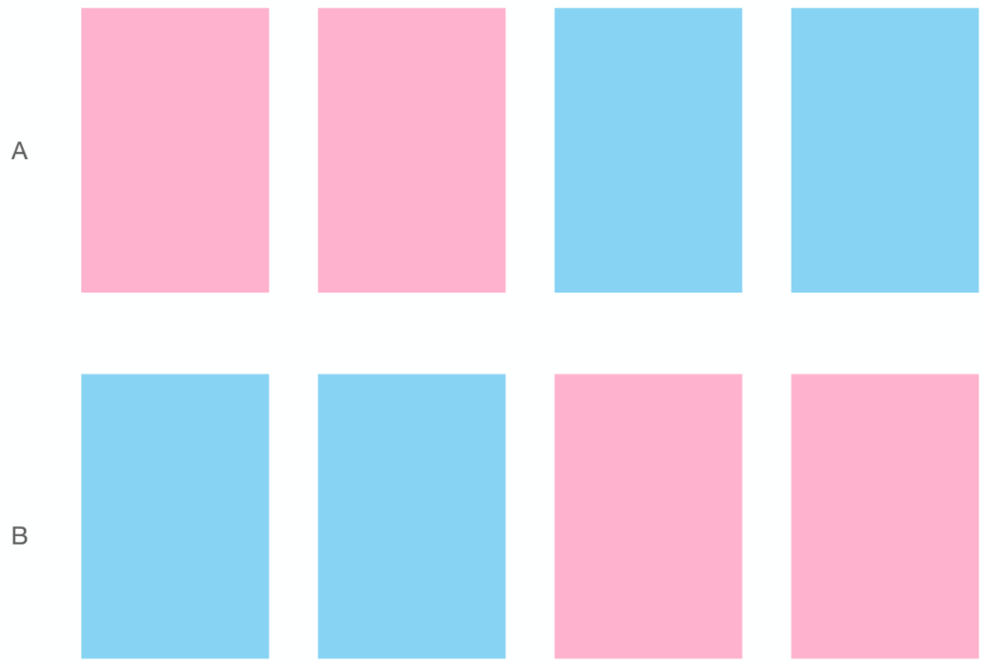
Figure 1

Iowa Gambling Task (IGT) Manipulations



Note. This figure displays the IGT deck manipulations. In Version A, the pink decks are the disadvantageous decks (Decks A and B) and the blue decks are the advantageous decks (Decks C and D). In Version B, the blue decks are the disadvantageous decks (Decks A and B) and the pink decks are the advantageous decks (Decks C and D).

Figure 2

IGT Deck Comparisons

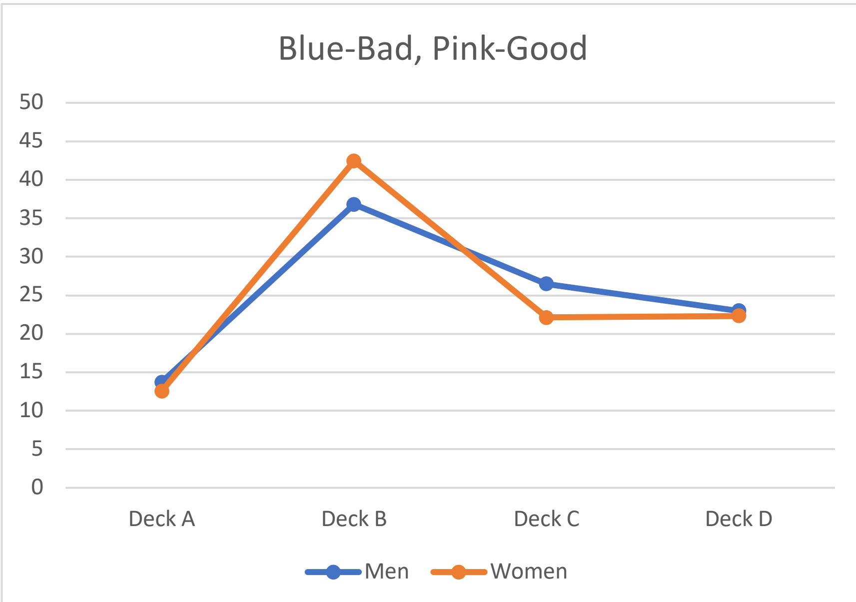
Deck	**Short-Term Win**	**Short-Term Loss**	**Frequency-Loss**	**Long-Term Outcome**
A	High ($100)	Low (-$250)	50% of trials	Loss > Gain
B	High ($100)	High (-$1250)	10% of trials	Loss > Gain
C	Low ($50)	Low (-$50)	50% of trials	Loss < Gain
D	Low ($50)	High (-$250)	10% of trials	Loss < Gain

Note. This figure displays deck information regarding the short-term and long-term outcome of each IGT deck along with their frequency of losses.

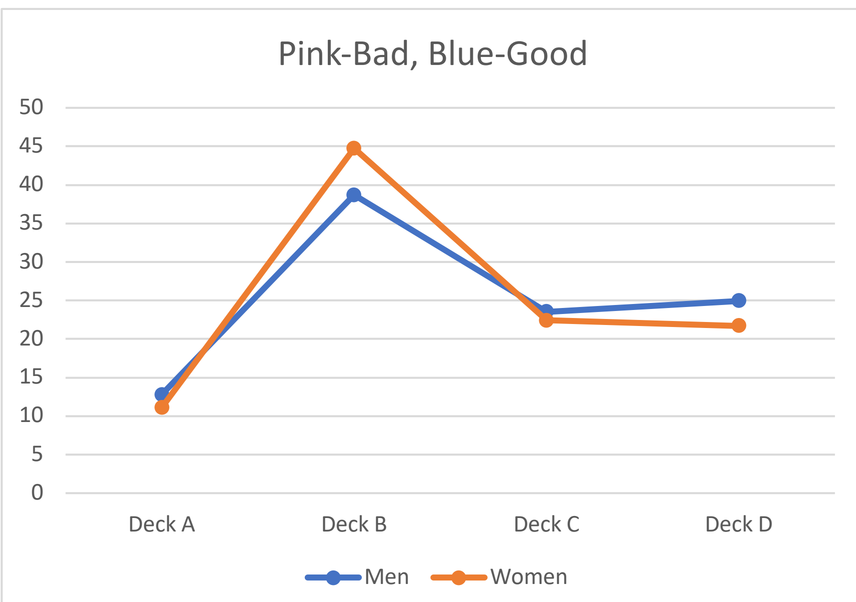
Figure 3

Study 1: IGT Condition x Participant Gender x IGT Deck Selections

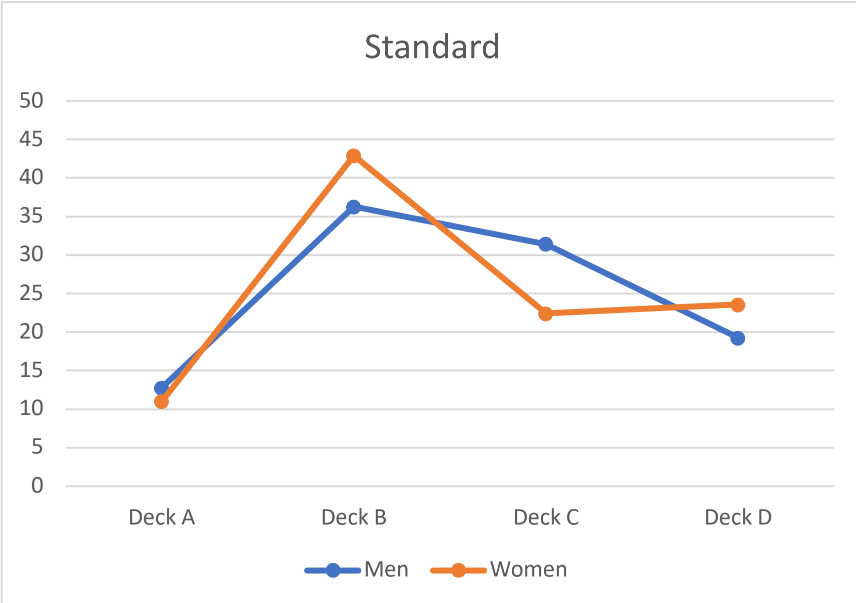
3-A



3-B



3-C

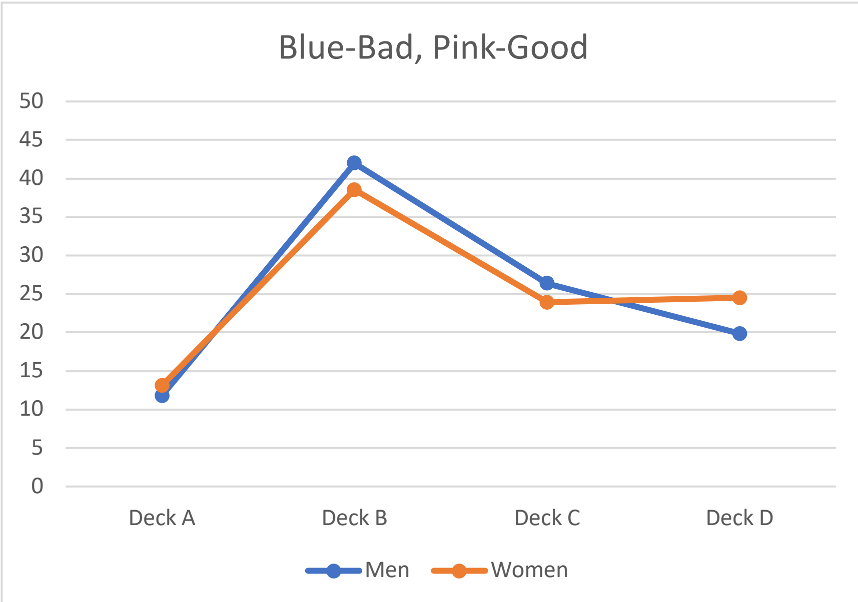


Note. The figures depict the pattern of individual deck selections, collapsed across all 100 trials, by participant self-reported gender identity and study manipulation (A-pink good; B-blue good; C-standard).

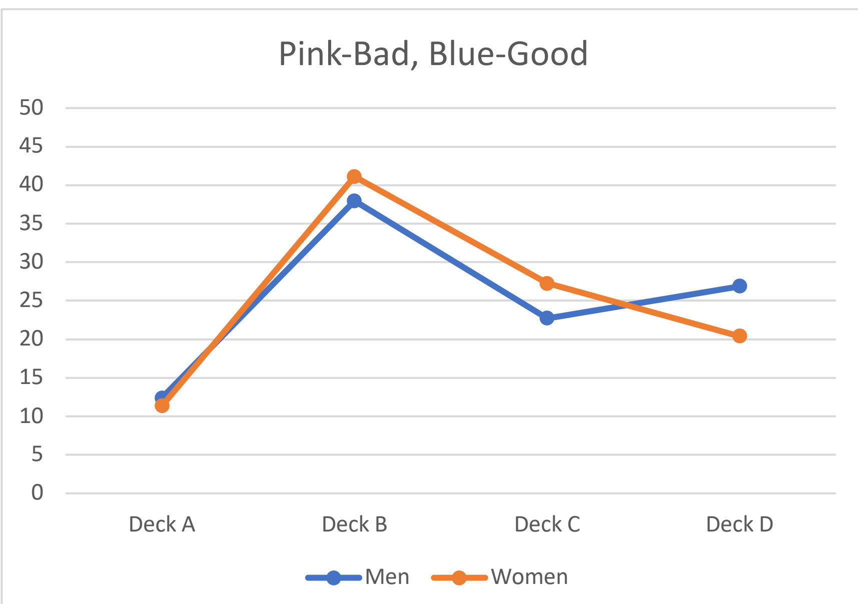
Figure 4

Study 2: IGT Condition x Participant Gender x IGT Deck Selections

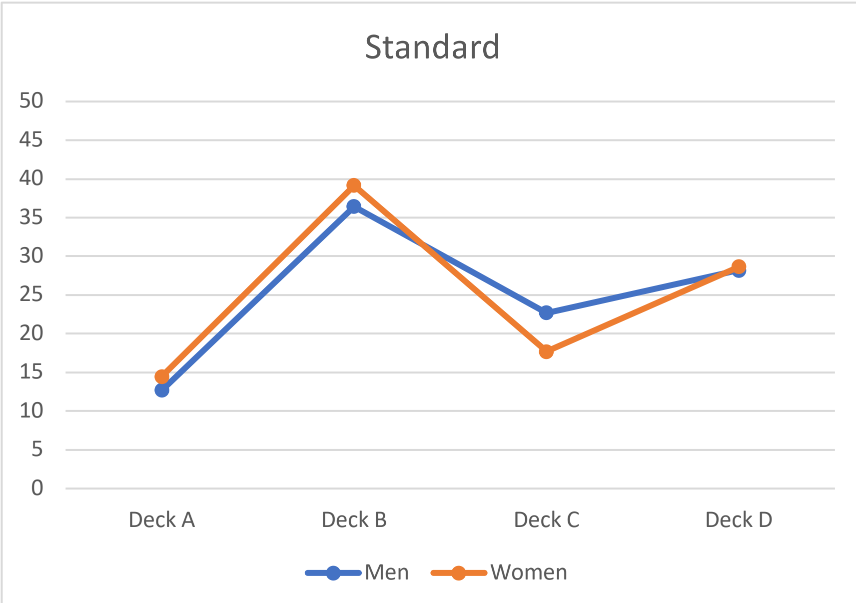
4-A



4-B



4-C



Note. The figures depict the pattern of individual deck selections, collapsed across all 100 trials, by participant self-reported gender identity and study manipulation (A-pink good; B-blue good; C-standard).

Table 1
Demographic data for Study 1 and Study 2

Variable	Total	Pink = Good	Blue = Good	Standard
		Study 1		
n	334	112	125	97
Age	41.43 (13.45)	40.77(13.06)	41.18(13.83)	42.52(13.46)
Sex at Birth				
Male	137	47	54	36
Female	194	64	69	61
Gender				
Male	137	47	54	36
Female	191	64	66	61
Transgender	2	0	2	0
Genderqueer/ nonconforming	1	0	1	0
Ethnicity				
American Indian/ Alaska Native	5	0	3	2
Asian or Asian American	19	5	8	6
Black or African American	42	15	14	13
Hispanic or Latino/a	28	13	11	4
Native Hawaiian or Pacific Islander	1	0	1	0
White or Caucasian	258	85	96	77
More than one ethnicity	6	1	4	1
Prefer not to answer	2	1	1	0
Other/ self-described	1	1	0	0
		Study 2		
n	720	312	174	233
Age				
Sex at Birth				
Male	233	91	57	85
Female	473	219	117	137
Gender				
Male	230	89	57	84
Female	458	211	113	134
Transgender	5	3	1	1
Genderqueer/ nonconforming	12	5	3	4
Other	1	1	0	0

Ethnicity				
American Indian/ Alaska Native	17	7	4	6
Asian or Asian American	41	19	13	9
Black or African American	102	45	22	35
Hispanic or Latino/a	74	30	15	29
Native Hawaiian or Pacific Islander	1	1	0	0
White or Caucasian	522	231	124	167
More than one ethnicity	20	8	5	7
Prefer not to answer	1	1	0	0
Other/ self-described	2	1	0	1

Note: Variables presented as mean(standard deviation) or total number of participants.

Table 2

Study 1 and Study 2 Variables Presented as Mean(Standard Deviation)

Variable	Total	Pink=Good	Blue=Good	Standard
		Study 1		
RSES	3.27(0.40)	3.32(0.39)	3.27(0.42)	3.22(0.37)
BFI-2-XSF				
Extraversion	2.79(0.94)	2.82(0.96)	2.66(0.96)	2.93(0.89)
Agreeableness	3.84(0.83)	3.74(0.92)	3.85(0.78)	3.96(0.78)
Conscientiousness	3.79(0.93)	3.82(0.95)	3.70(0.91)	3.89(0.91)
Negative Emotionality	2.73(1.09)	2.75(1.07)	2.80(1.11)	2.61(1.07)
Open Mindedness	3.85(0.83)	3.90(0.87)	3.83(0.79)	3.83(0.84)
IGT				
Net Score Block 1	-3.43(8.81)	-3.64(8.59)	-4.10(8.42)	-2.35(9.50)
Net Score Block 2	-3.77(10.10)	-4.21(9.09)	-3.70(10.17)	-3.34(11.16)
Net Score Block 3	-1.27(11.13)	-1.43(10.12)	-1.26(11.73)	-1.09(11.57)
Net Score Block 4	0.22(12.05)	0.77(11.64)	0.23(11.85)	-0.41(12.85)
Net Score Block 5	1.94(12.36)	1.50(11.97)	1.61(12.59)	2.86(12.59)
Total Deck A selections	12.18(8.39)	12.95(7.43)	11.92(8.56)	11.64(9.19)
Total Deck B selections	40.94(21.02)	40.56(20.37)	41.69(20.85)	40.44(22.13)
Total Deck C selections	24.18(20.09)	23.75(19.16)	23.33(19.46)	25.74(21.96)
Total Deck D selections	22.53(15.50)	22.42(14.83)	23.07(16.59)	21.98(14.97)
		Study 2		
RSES	3.67(0.93)	3.63(0.94)	3.63(0.94)	3.73(0.90)
BFI-2-XSF				
Extraversion	2.80(0.89)	2.81(0.89)	2.79(0.89)	2.79(0.90)
Agreeableness	3.82(0.78)	3.83(0.80)	3.85(0.75)	3.79(0.78)
Conscientiousness	3.54(0.93)	3.03(1.11)	3.53(0.94)	3.60(0.95)
Negative Emotionality	2.99(1.07)	3.96(0.82)	3.84(0.76)	2.89(1.04)
Open Mindedness	3.92(0.80)	3.96(0.82)	3.63(0.94)	3.91(0.80)
IGT				
Net Score Block 1	-3.28(8.38)	-3.58(8.38)	-3.75(8.20)	-2.49(8.49)
Net Score Block 2	-2.89(10.51)	-2.80(10.23)	-2.90(10.97)	-3.01(10.58)
Net Score Block 3	-0.79(10.92)	-0.66(10.90)	-0.62(10.97)	-1.09(10.97)
Net Score Block 4	1.09(11.51)	1.41(11.07)	0.98(11.17)	0.74(11.10)
Net Score Block 5	1.89(11.51)	1.43(11.38)	2.14(12.06)	2.34(11.28)
Total Deck A selections	12.76(7.89)	12.65(7.49)	11.70(7.67)	13.74(8.51)
Total Deck B selections	39.27(19.15)	39.56(18.24)	40.34(19.53)	38.02(18.09)

Total Deck C selections	23.34(18.69)	24.84(18.46)	25.44(19.23)	19.61(18.10)
Total Deck D selections	24.67(16.98)	23.00(16.37)	22.59(16.91)	28.63(17.25)

Note. Variables presented as mean(standard deviation).

Appendix A
Rosenberg Self Esteem Scale (RSES)

Please indicate the degree of your agreement or disagreement with each of the 10 statements listed below. You should indicate your agreement or disagreement by selecting a number for each statement. The number should be anywhere from 1 to 5, according to the following scale:

1 = strong <u>disagreement</u>
2 = <u>disagreement</u>
3 = neither agreement nor disagreement
4 = <u>agreement</u>
5 = strong <u>agreement</u>

1. __ I feel that I'm a person of worth, at least on an equal basis with others.
2. __ I feel that I have a number of good qualities.
3. __ All in all, I am inclined to feel that I am a failure.
4. __ I am able to do things as well as most other people.
5. __ I feel I do not have much to be proud of.
6. __ I take a positive attitude toward myself.
7. __ On the whole, I am satisfied with myself.
8. __ I wish I could have more respect for myself.
9. __ I certainly feel useless at times.
10. __ At times I think I am no good at all.

Appendix B

Big 5 Inventory 2-Extra Short Form (BFI-2-XS)

Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who *likes to spend time with others*? Please blacken the number which indicates the extent to which you agree or disagree with that statement.

1 = Disagree strongly
2 = Disagree a little
3 = Neutral; no opinion
4 = Agree a little
5 = Agree strongly

I See Myself as Someone Who...
1. Tends to be quiet. _____
2. Is compassionate, has a soft heart. _____
3. Tends to be disorganized. _____
4. Worries a lot. _____
5. Is fascinated by art, music, or literature. _____
6. Is dominant, acts as a leader. _____
7. Is sometimes rude to others. _____
8. Has difficulty getting started on tasks. _____
9. Tends to feel depressed, blue. _____
10. Has little interest in abstract ideas. _____
11. Is full of energy. _____
12. Assumes the best about people. _____
13. Is reliable, can always be counted on. _____
14. Is emotionally stable, not easily upset. _____
15. Is original, comes up with new ideas. _____

Appendix C
Instructions for the Iowa Gambling Task

In this experiment, you will be asked to repeatedly select a card from one of the four decks above. You can select a card by clicking the mouse on one of the decks. With each card, you can win some money, but you can also lose some. Some decks will be more profitable than others. Try to choose cards from the most profitable decks so that your total winnings will be as high as possible. You will get 100 chances to select a card from the deck that you think will give you the highest winnings. Your total earnings and the number of cards selected will be displayed on the screen. You start with $2000. You will not earn real money on this task. Please treat the virtual money as real money, and make decisions as if it were your own money. Click 'Start' to begin.

Appendix D
Instructions for Implicit Association Test

In this task you will press the 'E' key (left response key) or the ‘I' key (right response key) to categorize words into groups as fast as you can. Here are the four groups and the words that belong to them:

Gender x Science/Liberal Arts version:

Category	Items
Male	Man, Boy, Father, Male, Grandpa, Husband, Son, Uncle
Female	Girl, Female, Aunt, Daughter, Wife, Woman, Mother, Grandma
Science	Biology, Physics, Chemistry, Math, Geology, Astronomy, Engineering
Liberal Arts	Philosophy, Humanities, Arts, Literature, English, Music, History

Gender x Good/Bad Terms version:

Category	Items
Male	Man, Boy, Father, Male, Grandpa, Husband, Son, Uncle
Female	Girl, Female, Aunt, Daughter, Wife, Woman, Mother, Grandma
Science	Biology, Physics, Chemistry, Math, Geology, Astronomy, Engineering
Liberal Arts	Philosophy, Humanities, Arts, Literature, English, Music, History

Gender x Subordinate/Supervisor version:

Category	Items
Male	Man, Boy, Father, Male, Grandpa, Husband, Son, Uncle
Female	Girl, Female, Aunt, Daughter, Wife, Woman, Mother, Grandma
Science	Biology, Physics, Chemistry, Math, Geology, Astronomy, Engineering
Liberal Arts	Philosophy, Humanities, Arts, Literature, English, Music, History

Gender x Career/Family version:

Category	Items
Male	Man, Boy, Father, Male, Grandpa, Husband, Son, Uncle
Female	Girl, Female, Aunt, Daughter, Wife, Woman, Mother, Grandma
Science	Biology, Physics, Chemistry, Math, Geology, Astronomy, Engineering
Liberal Arts	Philosophy, Humanities, Arts, Literature, English, Music, History

Put your left finger on the 'E' response key for items that belong to the category 'Male', Put your right finger on the ‘I' response key for items that belong to the category 'Female’, Items will appear one-by-one in the middle of the screen. If you make an error, a red X will appear - to continue, press the other response key. Go as fast as you can while making as few errors as possible.

Put your left finger on the 'E response key for items that belong to the category ‘[Liberal Arts/ Good/Subordinate/Family]’. Put your right finger on the l' response key for items that belong to the category '[Science/Bad/Supervisor/Career]’. If you make an error, a red X will appear - to continue, press the other response key. Go as fast as you can while making as few errors as possible.

Press the left 'E' key for '[Liberal Arts/Good/Subordinate/Family]' and 'Male', Press the right 'I' key for '[Science/Bad/Supervisor/Career] ' and 'Female', If you make an error, a red X will appear - to continue, press the other response key. Go as fast as you can while making as few errors as possible.

This is the same task as the previous one. Press the left 'E' key for '[Science/Bad/Supervisor/Career]' and 'Male'. Press the right 'I' key for ''[Liberal Arts/Good/Subordinate/Family] and 'Female.' Each item belongs to only one category. Go as fast as you can while making as few errors as possible.

Second instructions part-way through task:
Attention! The labels have changed sides. Press the left 'E' key for 'Female.' Press the right "I' key for 'Male'. Go as fast as you can while making as few errors as possible.

Press the left 'E key for '[Liberal Arts/Good/Subordinate/Family]' and 'Female'. Press the right "I' key for '[Science/Bad/Supervisor/Career]' and 'Male'. If you make an error, a red X will appear - to continue, press the other response key. Go as fast as you can while making as few errors as possible.

This is the same task as the previous one. Press the left 'E key for '[Liberal Arts/Good/Subordinate/Family]' and 'Female' Press the right 'I' key for '[Science/Bad/Supervisor/Career]' and 'Male.' Each item belongs to only one category. Go as fast as you can while making as few errors as possible.

End of task feedback:
Your IAT score (D) was XXX, which suggests [strong automatic/moderate automatic/slight automatic/little to no automatic] preference to associate:

> "'Male' with '[Science/Bad/Supervisor/Career] ' rather than with [Liberal Arts/Good/Subordinate/Family]" or "'Male' with '[Liberal Arts/Good/Subordinate/Family]' rather than with '[Science/Bad/Supervisor/Career]'."
>
> "'Female' with '[Liberal Arts/Good/Subordinate/Family]'' rather than with '[Science/Bad/Supervisor/Career]" or "'Female' with '[Science/Bad/Supervisor/Career]' rather than with '[Liberal Arts/Good/Subordinate/Family]'."

Press the spacebar to complete this session.