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Perceived time pressure and the Iowa Gambling Task

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Abstract

The purpose of the present study was to investigate the effect of perceived time pressure on a learning-based task called the Iowa Gambling Task (IGT). One hundred and sixty-three participants were randomly assigned to one of two groups. The experimental group was informed that the time allotted was typically insufficient to learn and successfully complete the task. The control group was informed that the time allotted was typically sufficient to learn and successfully complete the task. Both groups completed the IGT and performance was recorded. The major finding was that participants who were advised that the amount of time allotted was typically insufficient to complete the task performed significantly worse than those who were advised that time was typically sufficient to complete the task.

Keywords: Iowa Gambling Task; decision making; time pressure.

1 Introduction

Research shows that real time constraints adversely influence IGT performance (Cella, Dymond, Cooper, & Turnbull, 2007). There remains a need, however, to determine how *perceived* time pressure affects IGT decision-making. In essence, is IGT performance impaired by real time constraints or simply the *perception* of time constraints? The present research was designed to determine how perceived time pressure influences IGT performance.

1.1 The Iowa Gambling Task and the Somatic Marker Hypothesis

The IGT is a well-established assessment tool, and its use by researchers has helped reveal the value emotions play in at least some forms of decision making (Evans, Kemish, & Turnbull, 2004). Because the IGT involves uncertainty, reward, and punishment, it is thought to simulate real-world decision-making (Bechara, Damasio, Damasio, & Lee, 1999). In the IGT, participants choose from among fours decks of cards with the goal of making as much money as possible. For each card selected, the participant receives a reward (i.e., s/he wins money). On some trials, however, an additional punishment is experienced (i.e., s/he loses money). Two decks — A and B — have high gains but larger relative losses; that is, the decks have negative utility (they are "bad decks"). The two remaining decks — C and D — have smaller rewards than decks A and B, but the wins outweigh the losses; that is, the decks have positive utility (they are "good decks"). The goal of the task is to maximize profit on a loan of play money.

In one study using the IGT, Bechara et al. (1999) tested three groups of people: healthy controls, people with lesions in the brain's ventromedial prefrontal cortex, and people with lesions in the amygdala of the brain. All participants performed the IGT while their skin conductance responses were measured. The healthy participants generated skin conductance responses at two different points throughout the task. First, presumably because they were having emotional responses to the rewards and punishments received, participants generated skin conductance responses after selecting each card. Second, within the selection of the first twenty cards, normal participants began generating skin conductance responses prior to the selection of cards, and these "anticipatory" skin conductance responses were most pronounced when selecting cards from one of the two bad decks. Conversely, people with ventromedial prefrontal cortex or amygdala lesions failed to generate anticipatory skin conductance responses before selecting bad cards and continued to select from the bad decks throughout the 100 card selections (Bechara et al., 1999). This observation, as well as data from other studies (e.g., Bechara, Tranel, Damasio, & Damasio, 1996; Bechara & Damasio, 2005: Ernst, Bolla, Mouratidis, Contoreggi, Matochik, Kurian, Cadet, Kimes, & London, 2002; but see Maia & McClelland, 2004), support the Somatic Marker Hypothesis (SMH; Damasio, 1994).

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The SMH postulates that decision making is influenced by emotion-based biasing signals (somatic markers) that occur during the consideration of options in the decision making process (Bechara & Damasio, 2005). For every decision option available, a somatic state is generated either by physiological changes within the body proper (the "body loop") or the brain's mental representation of the anticipated physiological responses that would take place in the body (the "as if body loop") (Dunn, Dalgleish, & Lawrence, 2006). These somatic states are thought to aid in rapid choice selection under time pressure (Pfister & Bohm, 2008). When making decisions, impairment of these emotional signals can adversely affect speed of deliberation and cause people to make sub-optimal decisions (Bechara & Damasio, 2005). For example, Manes and colleagues (2002) found that patients with emotional processing deficits resulting from orbitofrontal lesions in the brain evidenced prolonged deliberation and impaired IGT performance.

1.2 IGT in the real-world

Although research involving the IGT has frequently focused on clinical populations (e.g., Bechara et al., 1999; Levine, Black, Cheung, Campbell, O'Toole, & Schwartz, 2005; Best, Williams, & Coccaro, 2002), researchers have also uncovered daily life factors that affect IGT performance in healthy individuals. Cella and colleagues (2007), for example, found that people who were given less time to select a card performed worse relative to those who were given more time to select a card. de Vries, Holland, and Witteman (2008) found that, compared to people in negative mood states, people in positive mood states selected more cards from the good decks during the second block (i.e., cards 21–40) of the game. These studies provide evidence that time pressure and mood can affect IGT performance.

A question then arises as to the potential effect of *perceived* time pressure on IGT performance. Although most studies have treated time-pressure as a task characteristic, researchers have also found that the mere perception of time pressure may affect cognitive performance (e.g., Maule & Maillet-Hausswrith, 1995). One model linking perceived time pressure to task performance, the Variable State Activation Theory, suggests that impaired decision making performance can occur when the individual feels time is insufficient to successfully perform the task at hand (Maule & Hockey, 1993). One reason for this is that people change the strategies they use to make decisions when they feel time pressure. For example, the sequential comparison approach posits that people consider fewer variables when they feel a need to make faster decisions (Aschenbrener, Albert, & Schmalhofer, 1984; Busemeyer, 1985).

Because perceived time pressure may affect both strategies employed and emotional experiences while people make real-life decisions, it is important to assess how perceived time pressure affects performance on a realistic decision-making task such as the IGT. Interestingly, opposite results are possible. When time is perceived as insufficient, participants' IGT performances may be improved if they rely more heavily on emotional processes, which are thought to be integral to good IGT performance (e.g., Bechara et al., 1999). Conversely, because IGT performance is also based on cognitive processes (e.g., Maia & McClelland; 2004; Yechiam, Goodnight, Bates, Busemeyer, Dodge, Pettit, & Newman, 2006), the perception of time pressure may impair IGT performance because people might reduce the number of variables they consider when selecting cards.

1.3 The present study

The purpose of the present study, then, was to explore the effect of perceived time pressure on IGT performance. The experimental group was informed that the time allotted was typically insufficient to successfully complete the task while the control group was informed that the time allotted was typically sufficient to complete the task. Although Cella and colleagues (2007) found that *actual* time limits impaired IGT performance, the present study explored how the perception of time pressure affects IGT performance. The differences between these two studies are as follows: First, Cella and colleagues (2007) did not provide any information to their participants regarding whether the time allotted was sufficient or insufficient. Rather, they instructed their participants by saying, "Your task is to select one card at a time as fast as you can…" (Cella et al., 2007). Second, in Cella et al.'s (2007) study, the message "Too slow!" was displayed on the screen whenever a participant failed to make a card selection within the specified time limit. Finally, card selections were not recorded on trials that the participant was too slow; this resulted in fewer than 100 trials per participant (Cella et al., 2007). In the present study, the only instructions involving the perception of time pressure were provided at the start of the task and all 100 trials for every participant were used in the analysis. As a result of these differences in experimental design, the focus in the present study shifted from exploring how actual time pressure affects IGT performance to how perceived pressure affects it[1]

[1]The present study also manipulated the amount of time each subject had to make decisions on each trial of the IGT. However, because the effectiveness of the manipulation was questionable and because the manipulation did not significantly influence IGT performance, these results are not discussed.

2 Methods

2.1 Subjects

Participants were undergraduate students attending a private Midwest university enrolled in an introductory psychology course. A total of one hundred and sixty-three participants completed the study.

2.2 Apparatus and Materials

The present study included three standard personal computers running Windows 98. Additional software included the IGT application. Each computer was placed in a separate room with a door to minimize external noise. Standard 15-inch monitors were used and placed about 15 inches from the participant.

In the IGT, participants were presented four decks of cards on a computer screen. The decks were labeled A, B, C, and D. Using a mouse, the participant was allowed to select a card from any of the four decks. The participant selected one card at a time from any of the four decks and was free to switch from one deck to another at any time. After selecting a card, a message was displayed indicating the amount of play money won (reward). On some cards, the win message was followed by a message indicating the amount of play money lost (punishment). At the top of the screen was a green bar that changed according to the amount of money won or lost. Below the green bar was a red bar that showed the amount of money borrowed; this amount was $2,000.00 at the beginning of the game. The difference between the two bars was the total amount of play money won or lost. The goal of the task was to maximize profit on a loan of play money.

The sample in the present study was randomly divided into two groups. Both groups were instructed to select a card within two seconds of seeing "pick a card" on the computer screen. Perception of time was manipulated by informing the experimental group that the time allotted was typically insufficient to learn and successfully complete the task while the control group was informed that the time allotted was typically sufficient to learn and successfully complete the task.

2.3 Procedure

After each participant signed a consent form, the experimenter gave written instructions for the IGT, informed the participant that s/he had 2 seconds to select each card and that the time provided was either sufficient (control group) or insufficient (experimental group) to learn and successfully complete the task. The gambling task instructions used for both groups were the standard instructions used in other IGT experiments (e.g., Bechara, Tranel & Damasio, 2000; Bechara & Damasio, 2005). Once the participant indicated s/he understood the instructions, s/he was allowed to start the IGT.

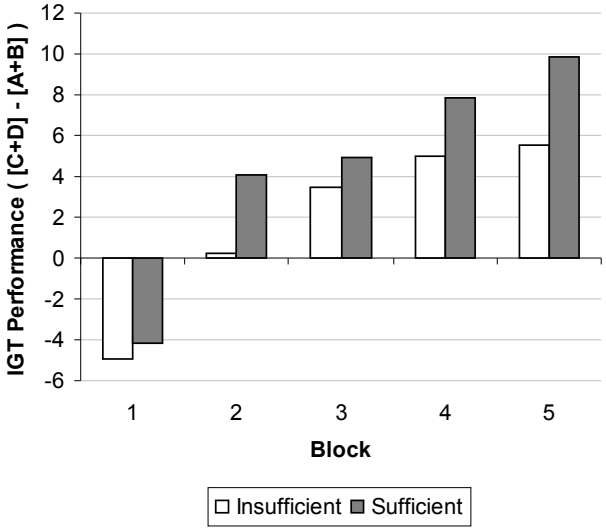

Figure 1: IGT performance as a function of perceived time pressure and block.

3 Results

The dependent variable for data analyses was the number of selections from good decks C and C minus the number of selections from bad decks A and B (i.e., [C+D]–[A+B]). If a participant selected more bad relative to good decks, s/he would have a negative score. As is typical in research involving the IGT (e.g., Bechara et al., 2000), the 100 card selections were separated into five blocks of twenty cards (i.e., Block 1 = Trials 1–20, Block 2 = Trials, 21–40 . . . Block 5 = Trials 81–100). This allowed for the tracking of changes in performance as the participants played the game.

Figure 1 shows the results. A 2 (Sufficiency: Insufficient, Sufficient) x 5 (Block: 1–20, 21–40, 41–60, 61–80, 81–100) ANOVA found that main effect for the between-subjects factor of Sufficiency was significant $F(1,161) = 8.404$, $p = .004$. Collapsing across Blocks, the Sufficient group (M = 22.49, SD = 30.53) selected more cards from the good decks than the Insufficient group (M = 9.14, SD = 27.90). The Block by Sufficiency interaction was not statistically significant, $F(4,644) = 1.877$, $p = .113$. In addition, the within-subjects factor of Block was significant $F(4,644) = 73.810$, $p = .000$. As can be seen in Figure 1, collapsing across both groups, participants increasingly sampled from good decks as the game progressed. Post-hoc analyses using the least significant difference (LSD) test revealed significant differences ($p <$

.05) in performance between each individual block and all other blocks.

4 Discussion

The present study was the first to investigate the relationship between perceived time pressure and IGT performance. Participants who were advised that the time allotted was insufficient performed worse than those who were advised that time was sufficient. This finding further supports the Variable State Activation Theory by demonstrating that perceived time pressure impairs performance on a real-life decision-making task.

It is worth noting that the perception of time pressure impaired IGT performance over an extended period of time. Other manipulations have been found to cause transient changes in IGT performance. For example, de Vries et al. (2008) found that negative mood was associated with fewer good card selections during Block 2 of the IGT only. In the present study, the perception of time insufficiency did not interact with block thereby suggesting that the mere perception of time pressure may be a more robust factor in IGT performance than mood. It is also notable that, compared to the Cella et al. (2007) study which reminded participants throughout the task that they were under real time pressure, the present study informed participants only once (prior to IGT administration) that the time allotted was either sufficient or insufficient. It appears that the communication of time insufficiency – even when announced only once — can have a long-lasting effect on real-life decision-making.

There are specific real-world benefits to understanding the effects of perceived time pressure on decision making performance. For example, research has found that members of project teams who perceived a high degree of time pressure had lower job satisfaction and felt that overall project objectives were less often attained (Nordqvist, Hovmark & Zika-Viktorsson, 2004). This finding, taken together with the present research, suggests that employee performance and overall project success may benefit from building a sense of adequacy in a project's time-line.

Perhaps nowhere can the impact of increased time pressure be seen than in the practice of medicine. The advent of Health Maintenance Organizations (HMOs) appears to have reduced the amount of time physicians spend with patients. In fact, one study found that HMO physicians were allotted significantly less time for new patients (31 minutes) than those practicing either solo (39 minutes) or in academic settings (43 minutes), and 83% of HMO family physicians felt their allotted time was insufficient to provide appropriate diagnosis (Linzer, Konrad, Douglas, McMurray, Pathman Williams, et al., 2000). Not surprisingly, Tamblyn and colleagues (1997) found that physicians tend to prescribe inappropriate medications during shorter office visits. Although more time may be needed to optimize diagnostic accuracy, it may also be beneficial for managers of HMO's to work more closely with their physicians in instilling a sense of sufficiency in current time allotments.

To conclude, we believe perceived time pressure can affect the quality of real-life decisions. The present study demonstrated that a belief of time being insufficient can impair IGT performance throughout the task. It remains to be determined why this happened.

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