Examining the validity in the clinical version of Iowa Gambling Task

Ching-Hung Lin1,2,3; Tzu-Jiu Song2; Ying-Ying Chen2; and, Yao-Chu Chiu 2,4*

1 Brain Research Center, National Yang-Ming University; 2Department of Psychology, Soochow University; 3Laboratory of Integrated Brain Research, Department of Medical Research & Education, Taipei Veterans General Hospital, Taipei Taiwan.

*Correspondence at: yaochu@mail2000.com.tw

Introduction

For more than a decade, the Iowa gambling task (IGT) [1, 2] has been utilized to test numerous mental deficits induced by neurological damage or psychiatric disorders [3]. The IGT has recently been standardized for testing 13 different neuropsychological disorders. Moreover, the IGT is now published and sold by the PAR, Inc., as a neuropsychological test (http://www3.parinc.com/products/product.aspx?productId=IGT). However, this test has many problems that must be resolved. The “prominent deck B phenomenon” may be the most serious problems associated with the IGT [4, 5]. This phenomenon in growing number of IGT studies indicates that normal decision-makers prefer bad deck B. Choice behavior in the IGT can be interpreted by gain-loss frequency rather than inferring future consequences. However, no experiment evidence has demonstrated that the “prominent deck B phenomenon” exists in the clinical version of IGT.

Method

In total, 72 participants (35 males and 37 females) performed the clinical version of IGT (2006). Each subject performed the computerized clinical-version 3 runs; that is, 300 trials (3 runs x 100 trials) were run to assess the extended preference of subjects in the clinical version of IGT.

Results

Long-term outcome (decks C and D vs. A and B) (F(1,71)=30.97, P<.01) and gain-loss frequency (decks B and D vs. A and C) (F(1,71)=31.35, P<.01) were significant. However, the “prominent deck B phenomenon” was observed during each run of the clinical version. Bad deck B was chosen nearly as frequently as good decks C and D, and significantly more than A, even during the third run (Figure 1, 2, 3).

Discussion

Using the 300 trials for statistical testing, the effects of long-term outcome and gain-loss frequency were both supported. However, using the stage by stage analysis for each deck, we found that the disadvantageous deck A was chosen less gradually from 1st stage to 3rd stage. The significant difference was observed particularly between 1st stage and 2nd stage. The descending learning-curves of decks C and D were revealed in each two stages. The basic assumption of clinical version IGT proposed that normal controls can hunch the final benefit in the standard administration of IGT (100 trials, within only 1st stage). However, the present result indicated that the most subject is difficult to hunch the final-outcome completely in the 1st stage, even in the 3rd stage of IGT (Figure 4, 5, 6).

Conclusion

Experimental results suggest that the “prominent deck B phenomenon” existed in the clinical version of IGT. The existence of the “prominent deck B phenomenon” means that gain-loss frequency was the primary guiding factor for decision-makers, not long-term outcome. Therefore, those using the IGT should be very careful when interpreting patient results during assessment.

References


Acknowledgements

The authors would like to thank Ministry of Education & Soochow University and National Science Council, Taiwan for financially supporting this research under Contract No. MOE-SCU97A13304. and NSC96-2413-H-031-002-MY2. Ted Knoy is appreciated for his editorial assistance.
Reexamining the Aging Effect in the Iowa Gambling Task
Ching-Hung Lin1,2,3, Ruei-Jyun Hung2, Yao-Chu Chiu2*, Shi-Shih Yen2, Chao-Chih Wang2, and Tzu-Jiun Song2
1Brain Research Center, National Yang-Ming University; 2Department of Psychology, Soochow University; 3Laboratory of Integrated Brain Research, Department of Medical Research & Education, Taipei Veterans General Hospital, Taipei Taiwan.
*Correspondence at: yaochu@mail2000.com.tw

Introduction
The Iowa gambling task (IGT) is extensively adopted as a diagnostic test for several neurological disorders. However, task validity remains contentious. For instance, the aging effect on real-life decisions is contested. For instance, McPherson et al. [1] pointed out that no significant difference exists between elders and the young in the IGT. However, Denburg et al. [2, 3] and Fein et al. [4] suggested that the performance of elderly was poorer than that of the young in the IGT. Thus, whether the IGT can distinguish between decision patterns of the old and young remains unknown.

Method
This study recruited 48 subjects aged 50–96 years old and 48 college students aged 18–22 years. All subjects performed the computerized version of the IGT. The expected value of decks A and B are negative, and the expected value of decks C and D are positive [Table 1]. The age range of those over 50 in this study is relatively larger than that in previous studies. The male to female ratio was balanced in and between groups. Each subject performed 100 trials of the game. Some of those over 50 who had never used a computer and mouse were asked to use a finger to point to the decks they chose on the screen and an experimenter helped him/her turn cards.

Results and Discussion
This empirical study identified an age effect (F(3, 90)= 3.769, P<.05); however, the greatest difference between the young and old was focused on bad decks A (f(47)= 3.47, P<.01) and B (t(47)=2.37, P<.05). Most subjects in both groups preferred decks B, C, and D over deck A. The mean number of cards chosen by the elder group was A (20.71), B (28.35), C (25.96), and D (24.98) [Figure 1], and that for the younger group was A (16.6), B (32.90), C (24.31), D (26.19) [Figure 2, 4]. However, the "prominent deck B phenomenon" was observed in both groups. In summary, those aged over 50 who had an average choice pattern for the four decks (close to the chance level) than that of the younger group. Our finding is partially consistent with McPherson et al. [2]. The choices of decks C and D between the old and the young have no significant difference. Our finding is also partially congruous with Denburg et al. [2, 3] and Fein et al. [4]. The choices of decks A and B between the old and the young have significant difference. Nevertheless, those over 50 chose bad deck A more than did the young, and chose bad deck B less than did the young.

Conclusion
This study demonstrates that most over 50 chose the four decks nearly average; however, the young were relatively easily influenced by the internal gain-loss structure of the IGT. It is worth noting that the prominent deck B phenomenon can be observed in both groups. This analytical result may imply that the young were relatively sensitive to gain-loss frequency than the older subjects under uncertainty.

References
Retesting the somatic feedback induced by caffeine in the Iowa Gambling Task

Ching-Hung Lin1,2,3, Shih-Ying Lin2, Shi-Shih Yen2, Yao-Chu Chiu 2,*
1Brain Research Center, National Yang-Ming University; 2Department of Psychology, Soochow University; 3Laboratory of Integrated Brain Research, Department of Medical Research & Education, Taipei Veterans General Hospital, Taipei, Taiwan
*Correspondence at: yaochu@mail2000.com.tw

Introduction
The Somatic Marker Hypothesis (SMH) suggests that peripheral somatic feedback (bodily loop) is crucial when making decisions. Bechara et al. [1, 2] demonstrated that healthy decision-makers can infer long-term outcome with the help of somatic signals. However, North and O’Carroll [3] and O’Carroll and Papps [4] manipulated somatic signals, indicating that changing the somatic signal did not influence decision-maker performance in the Iowa gambling task (IGT). Furthermore, Killgore et al. [5] demonstrated that caffeine did not improve the risk behavior induced by sleep deprivation in the IGT. However, Killgore et al. [5] did not use a control group that was not deprived of sleep. Therefore, this study experimentally tests the Killgore et al. study with a group without the sleep deprivation, but with the caffeine.

Method
The caffeine group had 25 subjects (12 males and 13 females) and the control group had 25 subjects (12 males and 13 females). Each subject of caffeine group drank a cup of coffee (320 ml, caffeine concentration: 68mg/100 ml). Each subject of control group drank some water or nothing over a 30-min period. The brand of coffee was unknown to subjects. After imbibing their respective liquids, each subject performed the computerized version of the IGT.

Results and Discussion
Experimental results indicate that no significant difference (t-test, df(24)) exists between the two groups in terms of IGT performance (A: p=.84; B: p=.84; C: p=.36; D: p=.30) [Figures 1, 2]. Namely, caffeine did not enhance or disturb subject preference for good decks C and D. However, the effect of final-outcome was insignificant for both groups (Control group: F(1,24)=.04, P=.85; Caffeine group: F(1,24)=.00, P=.98); the frequency effect was significant (Control group: F(1,24)=5.7, P<.05; Caffeine group: F(1,24)=26.91, P<.01); [Figures 3, 4] as most subjects preferred bad deck B, which is consistent with “prominent deck B phenomenon” suggested by Lin et al. [6].

Conclusion
Experimental results suggest the caffeine did not improve decision-maker behavior in the sleep-deprived group (Killgore et al., 2007) [5]. This experimental result may support the findings by North and O’Carroll (2001) [3] and O’Carroll and Papps [4], indicating (2003) that somatic signal change is not correlated with decision-making in the IGT. Nevertheless, the effect of gain-loss frequency (Chiu et al., 2008) [7] was predominant in this study.

References
Evaluating the “prominent deck B phenomenon” of the Iowa Gambling Task under the two payment procedures of gain and loss in an extended series of 300 trials

Ching-Hung Lin1, Yao-Chu Chiu2*, Jong-Tsun Huang3

1Department of Psychology, Soochow University; 2Brain Research Center, National Yang-Ming University, 3Graduate Institute of Neural and Cognitive Sciences, China Medical University; Taiwan.

*Correspondence at: yaochu@mail2000.com.tw

Introduction
The Iowa gambling task (IGT) uses a number of steps to simulate a real-life situation with uncertainty and a complicated instruction and payment is administered, such as a concurrent payment of both $100 gain and $150 loss within a trial across the whole series of 100 trials [1]. However, a number of studies have identified some validity problems in the IGT [2]. For example, the “prominent deck B phenomenon” [3] that is difficult to explain under the original scheme of IGT, was revealed by more and more research groups. This study experimentally tests the “prominent deck B phenomenon” with two major modifications. The first modification is to examine if the phenomenon and/or a myopia of long-term outcome still exist in an extended session of 300 trials. The second modification concerns with a comparison of the original concurrent payment of gain and loss in some selected trials (henceforth, Concurrent Version or cIGT) [Table 1] and a revised net payment mode by summatting the original gain and loss in the trial (Net Version or nIGT) [Table 2].

Method
In total, 48 college students (24 females and 24 males) were randomly assigned to two groups. Subjects in first group (12 females and 12 males) played the Net Version (nIGT), in which subjects received one monetary feedback during each trial (only the net gain or loss). Subjects in second group (12 females and 12 males) played the Concurrent Version (cIGT), in which subjects received one or two monetary feedbacks during each trial (always has a gain when it has a loss in some selected trials). To verify the learning effect, this study conducted 300 trials of the IGT (3 times the standard IGT) to monitor the lasting learning curve.

Results and Discussion
Empirical results demonstrate that no significant differences (t-test, df(23)) existed among choice patterns in the nIGT and cIGT (An-c:p=0.61; Bn-c:p=0.21; Cn-c:p=0.15; Dn-c:p=0.76). Most subjects preferred decks B, C and D over deck A in both versions across an extended series of 300 trials. The “prominent deck B phenomenon” was again revealed in both nIGT and cIGT. The present result may indicated that the manipulation of concurrent and net value procedure did not significantly influence the participants’ behavior.

Conclusion
Insignificant differences between cIGT and nIGT may indicate a strategy of net calculation was adopted by the subject irrespective of the payment procedures. Over the 300 trials of both IGT versions, the prominent deck B phenomenon [3, 4], which runs counter to the basic IGT assumption that decks are chosen based on long-term outcome, is still observed even under an extended series of 300 trials. This may indicate a myopia of long-term outcome still exists even after a long exposure of uncertainty condition.

References

Acknowledgements Thanks to the NSC (Taiwan) for financially supporting this research under Contract No. NSC96-2413-H-031-002-MY2. The authors appreciated C. C. Wang, H. Y. Wang and T. J. Song for their valuable reinspecting of the 300-trial launch and assistance in collecting the behavioral data.

Table 1

<table>
<thead>
<tr>
<th>Deck</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>100</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>100</td>
<td>100</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>-150,100</td>
<td>100</td>
<td>-50,50</td>
<td>50</td>
</tr>
<tr>
<td>4</td>
<td>100</td>
<td>100</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>-300,100</td>
<td>100</td>
<td>-50,50</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>100</td>
<td>100</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>-200,100</td>
<td>100</td>
<td>-50,50</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>100</td>
<td>100</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>9</td>
<td>-250,100</td>
<td>-1250,100</td>
<td>-50,50</td>
<td>50</td>
</tr>
<tr>
<td>10</td>
<td>-350,100</td>
<td>-1250,100</td>
<td>-50,50</td>
<td>-250,50</td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th>Deck</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>100</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>100</td>
<td>100</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>-50</td>
<td>100</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>4</td>
<td>100</td>
<td>100</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>-200</td>
<td>100</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>100</td>
<td>100</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>-100</td>
<td>100</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>100</td>
<td>100</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>9</td>
<td>-150</td>
<td>-1150</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>10</td>
<td>-250</td>
<td>100</td>
<td>0</td>
<td>-200</td>
</tr>
</tbody>
</table>

The internal structure of gain-loss frequency and final-outcome in nIGT

The internal structure of gain-loss frequency and final-outcome in cIGT

Figure 1 Mean number of card choice in cIGT

Figure 2 Learning curve of each deck in nIGT

Figure 3 Mean number of card choice in cIGT

Figure 4 Learning curve of each deck in nIGT
Decision-making in the Iowa and Soochow Gambling Tasks by Patients on Methadone Therapy
Ching-Hung Lin1, Yao-Chu Chiu2*, Chao-Chih Wang2, Ding-Ruey Yeh2, Tzu-Jiun Song2, Chih-Chieh Tseng3

1Brain Research Center, National Yang-Ming University; 2Department of Psychology, Soochow University; 3 Armed Forces Beitou Hospital Taipei, Taiwan

*Correspondence at: yaochu@mail2000.com.tw

Introduction
Bechara et al. [1-3] suggested that the Iowa gambling task (IGT) is sufficiently sensitive to distinguish between decision patterns of subjects with ventromedial prefrontal lesions, those with substance dependencies (SD) and normal controls. However, an increasing number of studies failed to replicate the original findings for the IGT [1] and researchers have started questioning the validity of the IGT [4-6]. Furthermore, Chiu et al. [6, 7], who utilized the Soochow gambling task (SGT) to test normal decision-makers, suggested that under uncertainty, subjects were guided by immediate gain or loss, not long-term outcome. Thus, this study conducted an experiment to verify the power of the IGT and SGT to assess those with SD, who may lack impulse control.

Method
This study recruited 27 heroin users who were on methadone therapy. Subjects played the computerized versions of the IGT [Table 1] and SGT [Table 2]. All subjects provided informed consent and spent 15–20 min playing the two computer games before taking the methadone. This behavioral test was approved by the IRB of the Armed Forces Beitou Hospital. A questionnaire was used to assess the total and extended preferences on the explicit level after each game.

Results and Discussion
IGT results indicate that the bad decks A and B was not significant highly chose then good decks C and D (F(1,26)=3.89, P=.059). Most SD subjects preferred bad deck B over the other three decks. The SD subjects gradually increased their preference for deck B and avoided bad deck A as the game progressed [Figure 1,3]. Conversely, SD subjects preferred bad deck A over the other three decks in the SGT and the effect of long-term outcome (gain-loss frequency) was significantly different (F(1,24)=7.15, P<.05). The learning curve indicated that SD subjects preferred the good final-outcome decks (C,D) gradually [Figure 2,4]. In fact, SD subjects' choice patterns were similar to that of normal subjects in previous IGT (with "prominent deck B phenomenon") and SGT studies (Chiu et al., 2008; Ahn et al. 2008).

Conclusion
The Bechara et al. [1-3] finding is not supported here. Experimental results indicate that the preference for bad decks B of SD subjects can be explained by myopia to long-term outcome or hypersensitivity to immediate gain in the IGT. However, SD subjects gradually learned to favor long-term outcome (good decks C and D) by the end of SGT; this finding is inconsistent with the basic assumption of the IGT.

References

Acknowledgements The authors would like to thank the NSC, Taiwan, for financially supporting this research under Contract No. NSC96-2413-H-031-002-MY2.
Comparing the uncertainty effects of two payment procedures under an extended series of 300 trials in the Soochow Gambling Task

Yao-Chu Chiu¹, Jong-Tsun Huang², Tzu-Jiun Song², Chao-Chih Wang¹, Ding-Ruey Yeh¹, Ching-Hung Lin¹,³,*

¹Department of Psychology, Soochow University; ²Graduate Institute of Neural and Cognitive Sciences, China Medical University; ³Brain Research Center, National Yang-Ming University, Taiwan.

*Correspondence at:  eandy924@ms42.hinet.net

Introduction

The Iowa gambling task (IGT) has been utilized in over 250 neurological, psychiatric studies and so on. This task was not only a research task, it has been a neuropsychological assessment test for 13 mental disorders [1]. However, many researchers argue against the basic assumption of the IGT and its supporting theory—the Somatic Marker Hypothesis (SMH). One argument was elucidated by Chiu et al. [2, 3], who developed a modified version of the IGT, namely, the Soochow Gambling Task (SGT), and demonstrated that normal decision-makers are guided by gain-loss frequency, not by long-term outcome. However, the SGT has one procedure that differs from that in the original IGT. In the SGT, a subject always receives a gain or loss in each trial (a net payment, or a Net Version), whereas in the IGT, a subject is generally given gain feedback after each card selection and only sometimes with an additional loss in a single trial (a concurrent payment of both gain and loss, or a Concurrent Version). Thus, the SGT may be considered not as uncertain as the original IGT. To mimic the original concurrent payment in the IGT, the present study investigated a comparison between the net payment of SGT (Net Version, nSGT) (Table 1) and a mimic concurrent payment of SGT (Concurrent Version, cSGT) (Table 2) and tested under an extended series of 300 trials.

Method

To clarify this question, 48 college students were enrolled in this study. In total, 24 subjects (12 females, 12 males) performed the original SGT (net payment, nSGT) and the other 24 subjects (12 females, 12 males) performed the concurrent payment SGT (cSGT). Each subject played 300 SGT trials on a computer. In both versions of the SGT, decks A and B result in a loss of $500 over 10 trials. Conversely, decks C and D result in a gain of $500 over 10 trials.

Results and Discussion

Experimental results indicate that the two versions of the SGT did not differ significantly (F(1,23)=.00, p=1.00). However, over 300 trials of the nSGT, most subjects gradually began to avoid bad decks A and B in favor of decks C and D [Figure 1, 2]. However, in the cSGT, subjects learned very slowly, even near the end of the 300 trials [Figure 3, 4]. The result may imply that the degree of uncertainty can also influence the implicit learning in the SGT. It is worth noting that cSGT and Iowa Gambling Task possessed almost the same degree of uncertainty, but subjects are difficult to hunch the long-term outcome completely even the end of 200 trials.

Conclusion

The choice behavior under nSGT and cSGT are supposed to experience the same degree of uncertainty. However, subjects seem to have more difficulty learning the internal rules of cSGT than of nSGT. Namely, decision makers are difficult to hunch the long-term outcome in cSGT rather than in nSGT under the 300-trials situation.

References


Acknowledgements The authors would like to thank the NSC, Taiwan, for financially supporting this research under Contract No. NSC96-2413-H-031-002-MY2.