



card from one of the four decks in each trial. Each deck consists of 40 cards, a half with black face (while outcome of gain only) and the other half with red face (while mixed outcome of gain and loss). The immediate gain of deck A and B is \$ 100, whereas of deck C and D is \$50. Regarding to the delayed loss, deck A is associated with 50% loss ranging from \$ 150 to 350, deck B is with 10% loss of \$ 1250, deck C is with 50% loss ranging from \$25 to \$75, and deck D is with 10 % of \$ 250. Consequently, selections of deck A and B lead to a negative expected value of \$-25, whereas selections of deck C and D lead to a positive expected value of \$25. Participants are given a \$2000 loan in the beginning of task. Given the fact that the expected values between decks are different, participants are encouraged to learn to stay at good decks for winning money as much as possible. Unknown to participants, there are totally 100 trials in the task (participants are instructed to play until the computer stops the game). Since each deck has 40 cards, participants are asked to select other decks if one deck is out.

Each trial begins with a screen of the deck A, B, C, and D laid out from left to right (Figure 6, up). This screen lasts until participants make selection by pressing a corresponding button. Once selection is made, a 5 s outcome message replaces the screen (Figure 6, middle). The



Figure 6. In the original IGT, each trial begins with a screen of four uncovered decks (up). Participants press a corresponding keyboard button to select a card. Once a card being selected, the outcome of the selected card is shown for 5 s (middle). Finally, play money account is updated and is shown to participants for 2 s (bottom).

outcome message is displayed on the selected deck, e.g., +100, -1250” (message mixed of gain and loss is associated with red card face) or “+100” (message of gain alone is associated with black card face). Next to the 5 s outcome message, participant’s play money account is updated and is shown for 2 s (Figure 6, bottom). Then, the trial ends, and the next trial comes up immediately.

### ***Procedure***

Upon arrival, participants were firstly given an introduction about the experiment, and then were requested to sign an informed consent form. Next, they were led to a noise attenuated room, seated in front of a 19” CRT monitor (refresh rate = 100 Hz). Participant’s eyes were adjusted to be horizontal to the screen center, and the distance between eyes and screen center was kept in a range of 80 to 100 cm. SCR electrodes were then attached. Experiment began after all preparations being finished.

In the beginning of the task, participants received verbal and visual instruction of the task (for instruction in Chinese, see Appendix A):

1. Now you are going to participate in a gambling game. There are several trials in the game. However, you can not know how long the game will continue. You must keep playing until the computer stops the game.
2. You will get \$2000 credit to start the game. At the end, we will see how much you won or lost.
3. The procedure of the game is as followed:
  - 1) In front of you on the screen, there are four decks of cards A, B, C, and D
  - 2) In each trial, you have to select one card from any of the four decks.
  - 3) After your card selection being made, the computer will tell you the result of the selected card. The symbol “+” and “-” on the card represent win and loss

respectively, and the number following the symbol represents the magnitude you win or loss. Every so often, however, when you select on a card, the computer tells you that you won some money, but then it says that you also lost some money. For example, “+500, -200” represents you can totally get \$300 at this trial.

- 4) At the end of each trial, your money account will be updated and will be shown on the screen center.
4. You are absolutely free to switch from one deck to another any time you wish.
5. Each time you select a card from a deck, the color of the card turns red or black. The colors of the cards are irrelevant in this game.
6. You may find yourself losing money on all of the decks. The computer does not make you win or lose money at random. The feedback of each card is preprogrammed before the game starts. You can try to find the rules to stay away from the worst decks. That will make you win more.
7. The goal of the game is to win as much money as possible and, if you find yourself unable to win, make sure you avoid losing money as much as possible.
8. Now please move your fingers to be on the keyboard buttons. The key 3, 6, 9, and \* correspond to deck A, B, C, and D respectively. You will do practice trials first. The game will start after the practice trials and after you make sure that you get fully understanding to the game.

In addition to the verbal and visual instructions, participants were also given a demonstration (provided by experimenter) which emphasized (a) The rule (and constraints) of the computerized task are identical to that of the task with real cards, and (b) staying in good decks could make them earn more. After participants got fully realized to the task, they were asked to take a 3 minutes rest, then the task began. The 100 trials were divided into 5 blocks, and there was a 1 minute break between each block. After all of the 100

trials being finished, the task ended. Participants were then debriefed, paid, and thanked for his/her participation.

### ***SCR Recording and Analysis***

Skin conductance responses (SCRs) was recorded from thenar and hypothenar areas of the palm of the dominated hand (see below) through Ag/AgCl electrodes which connected to Infiniti System (Thought Technology). SCR data were recorded continuously with 256 Hz sampling rate, and were collected simultaneously on an IBM X60 laptop. Synchronization of SCR data and task events were accomplished off-line by a program written in MatLab.

According to Bechara et al. (1999), there are two time windows for SCR analysis. The first one, anticipatory SCRs, is the period from trial begins to selection being made. Thus, it is not fixed, and is varying from trial to trial, from participant to participant. There are two subtypes of anticipatory SCRs: (a) anticipatory SCRs for bad deck (i.e., deck A, B) which is the average of trials where deck A or B is selected, and (b) anticipatory SCRs for good deck (i.e., deck C, D) which is the average of trials where deck C or D is selected. The second time window, feedback SCRs, is the 5 s immediately after the each card selection. The feedback SCRs represent the physiological responses to the outcome message which is given right after card selection. It consists of two subtypes: (a) gain SCRs which is the average of trials with immediate gain only, and (b) loss SCRs which is the average of trials with both immediate gain and delayed loss.

It is unfortunate that, although we collected SCR data in Experiment One, they will not be reported here because of two reasons: (a) Procedure error, that is, the electrodes were attached on participant's dominant hand, but the dominant hand was also used to make card selections in the task. Thus, artifacts caused by finger moving led the data

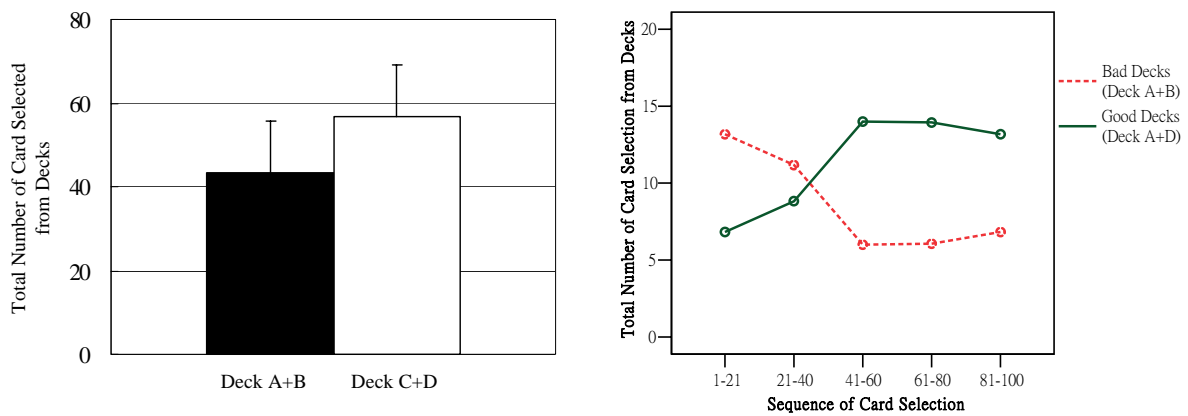


Figure 7. Total number of card selected from decks across the 100 trials (left) and by blocks (right).

analysis become problematic; and (b) insufficient window for anticipatory SCR analysis. According to Bechara and his colleagues (Bechara et al., 1999; Bechara et al., 2000), the average anticipatory window is 5 s. However, participants in our study only anticipated for 639.93 ms ( $SD = 237.87$  ms) in average to make selection. Given that no any event-related changes could be observed within such a short time, we decided to dismiss the SCR data in Experiment One. However, experiences from Experiment One made us to do some modifications of tasks in Experiment Two in order to have sufficient time to measure anticipatory SCRs (see below).

## Results

### Behavioral Data

Figure 7 shows the total number of card selected from decks across the 100 trials (left) and by blocks (right; each block consists of 20 trials). For examining whether participants selected more cards from good decks (i.e., C and D) than from bad decks (i.e., deck A and B), the number of good deck selection and of bad deck selection were counted respectively. A *t-test* was then proceeded and revealed that participants selected more cards from good decks than from bad decks across the 100 trials ( $t(16) = 2.27, p < .05$ ).

Thus, our data indicates that participants in Taiwan do perform similarly as the normal subjects reported in Bechara and his colleagues' studies (e.g. Bechara et al., 1994).

### *Summary*

The Experiment One aimed to replicate the original IGT with normal subjects. Although the lack of SCR data, our behavioral data still indicated that the findings reported previously can be replicated. That is, normal subjects in Taiwan do perform advantageously as Caucasian (Bechara et al., 1994; Carter & Pasqualini, 2004) and as Japanese (Suzuki, Hirota, Takasawa, & Shigemasu, 2003) people in the IGT.