“Random” Card Selection

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****** The data in this paper is completely made up ******

Contents

1 Introduction

In the board game Settlers of Cataan, as in many other games, players have occasion to steal a random card from an opponent's hand. Typically the victim will fan out his hand evenly, and the thief will choose which card to take (only seeing the identical card backs). Most people presume this to be a random selection, however humans are notoriously bad at simulating random acts[1]. With this in mind, we set out to determine if people tend to choose randomly when given this task or if there is a bias to any particular area of the hand of cards (e.g. the cards on the end, or the cards in the middle).

2 Data Collection

We solicited participation from passing students in UIC's Student Centre East on three afternoons, April 8, 9 and 10 2015. In total, 204 students participated in our experiment.

We used a hand of six playing cards, one of which was the Queen of Clubs. Subjects were told that if they chose the queen they would receive a Fun Size Snickers Bar. The cards were shuffled and fanned out facing away from the subject. After selecting the card, we recorded which card was chosen, 1-6 with 1 being the card on the left from the subject's perspective.

The number of subject choosing each card is as follows:

Card	1	2	3	4	5	6
Frequency	43	41	21	23	34	42

Figure 1: A hand of 6 cards

[1] In an academic paper, a reference to some other research would be required here, but that isn't necessary for this project.

3 Statistical Inference

First we wish to determine if people tend to choose from the left-half of the cards more often than the right-half or not. Cards 1-3 are considered the "left-half" of the hand.
$H_0 : p = .5$
$H_A : p > .5$
$\hat{p} = .5147$, has a p-value of .337, not significant at a 5% level. There is not enough evidence from our sample to suggest people favor one side or the other.

Next we wish to determine if people tend to choose from the ends of the hand rather than the middle. Letting cards 3 and 4 represent the "middle" of the hand, we would expect people to choose from these two cards 1/3 of the time if the choice was truly random. They test is performed as follows:
$H_0 : p = 1/3$
$H_0 : p \neq 1/3$
$\hat{p} = .2157$, with a p-value of approximately .000365, extremely strong evidence that people tend to choose from the sides of a hand rather than the middle. A 95% confidence interval for the probability a person chooses cards 3 or 4 is

$$(.15925, .27213).$$

4 Conclusion

Random selection of a card is yet another task that people cannot do well. For some reason people are biased to choose cards from the extremes of a hand of cards rather than the middle. Perhaps they think the center is not "random enough". For whatever reason, this fact can come in quite useful. Suppose, for instance, that you have been waiting all game to get your hands on an "iron ore" card. Your frenemy Charles rolls a 2, and you squeal with delight as you take into your hand a precious ore only to be stunned when Charles playes a "Knight" card to steal from your hand. The statistically safest place to put your ore is in the middle of your hand.

One must, however, question whether this sample of 204 UIC students is a representative sample from the larger population of all humans. There may be a bias among UIC students, people in the midwest, young adults or even Americans or people living in "Western Culture" which predisposes them to this extremes-of-the-hand bias. We leave this question open to future investigation.

5 Appendix

5.1 Data

Date	Card Selected
Apr 8	1 4 1 2 6 1 5 1 1 5 6 6 5 4 6 3 6 3 1 5 6 3 4 6 5 1 6 6 2 1 4 3 5 1 5 4
	2 6 1 2 1 1 6 1 1 5 3 2 4 6 6 1 2 5 4 6 5 6 3 4 6 5 3 1 2 1 2 6 6 5 3 4
Apr 9	2 6 4 6 2 5 1 6 3 2 2 1 2 6 3 5 6 6 5 1 1 5 3 2 1 2 1 1 6 1 1 1 1
	5 4 6 2 3 5 6 2 3 6 5 5 1 1 4 4 2 2 5 6 1 5 6 6 6 6 4 4 5 2 2 2 4
Apr 10	2 5 5 3 1 2 2 3 2 2 1 2 1 2 4 5 2 6 5 5 3 3 3 6 3 5 2 2 6 6 4 1 5
	2 4 3 5 1 1 2 1 6 6 1 1 1 5 4 5 3 4 6 4 2 2 2 2 4 2 6 1 5 2 1 6 2

5.2 Calculations

Do people choose cards 1-3 more often than cards 4-6?
$H_0 : p = .5$
$H_A : p > .5$
$n = 204$
$\hat{p} = 105/204 = .5147$
Under H_0, $se(\hat{p}) = \sqrt{p_0 q_0/n} = \sqrt{.25/204} = 0.035$
p-value $= P(\hat{P} > .5147 | p = .5) = P(Z > (.5147 - .5)/.035)) = P(Z > .42) = .33724$

Do people choose cards 3,4 with probability 1/3?
$H_0 : p = 1/3$
$H_0 : p \neq 1/3$
$n = 204$
$\hat{p} = 44/204 = .2157$
Under H_0, $se(\hat{p}) = \sqrt{p_0 q_0/n} = \sqrt{(1/3)(2/3)/204} = 0.033$
p-value $= 2 \times P(\hat{P} < .2157 | p = 1/3) = P(Z < (.2157 - 1/3)/.033)) = P(Z > .42) = .000365$

95% Confidence Interval for p, the probability a person chooses card 3 or 4.
$se(\hat{p}) = \sqrt{\hat{p}\hat{q}/n} = \sqrt{(.2157)(.7843)/204} = .0288$
$z_{\alpha/2} = 1.96$
$\hat{p} \pm z_{\alpha/2} se(\hat{p}) = .2157 \pm 1.96(.0288)$ gives $(.15925, .27213)$.

5.3 Work Breakdown

Brian Powers: Bought the cards, Data Collection section and Statistical inference sections

Bill Feldspar: Wrote introduction and conclusion

Both: Collected data, Computations, discussed document