Construction of a Probability Model of the Generals' Skills in the Game "Legends of the Three Kingdoms"

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CONTENTS

Abstract

The aim of this study is to figure out the optimization of survival probability of the generals in the card game "Legends of the Three Kingdoms".

First, based on combinatorics and probability theory, the PASCAL program was performed to analyze the probabilities of success when several popular generals perform their special skills in the game. The results are as follows:

Generals	Skill	Expectation
Zhou Tai	*Never Surrender*	4.52
Zhen Ji	*Goddess of Water*	0.98
Lu Xun	*Continuous Attack* with "*Zhuge crossbows*"	0.73
	without "*Zhuge crossbows*"	1.47
Zhang Jiao	*Thunder*	0.22

Second, seven typical generals, including Zhou Tai, Zhang Jiao, Zhen Ji, Lu Xun, Ma Chao, Xiahou Dun, and Guo Jia, were chosen, and their abilities including attacking and defense were arbitrarily quantified according to a model constructed in the present study. The scores are as follows:

Card-drawing	Changing	Attacking	Defense	Blood-selling
Zhen Ji	Zhou Tai	Ma Chao	Xiahou Dun	Guo Jia
5.62	1.04	1.68	1.19	3.36
Lu Xun	Zhang Jiao			
3.55	2.55			

The abilities of different generals were sorted, and by comparison with the statistical record online, the reliability of the model was proved. Thus, the irrationality of the game is identified in this study, and we recommend the game designer to modify the abilities of some generals and to obtain an optimized value according to the output of the model, by which the game would be more popular.

Keywords: Legends of the Three Kingdoms; general's skill; probability

摘要

本文以“三国杀”游戏中武将为例讨论存活概率最优化问题

首先，基于组合数学及概率理论知识，运用 PASCAL 程序对该游戏中一些常用武将使用技能的成功概率进行了运算分析，建立模型，得到结果如下表：

武将	技能	期望
周泰	不屈	4.52
甄姬	洛神	0.98
陆逊	连营（未装备“诸葛连弩”）	0.73;
	连营（装备“诸葛连弩”）	1.47
张角	雷击	0.22

其次，以较为典型七个武将：周泰，张角，甄姬，陆逊, 马超, 夏侯惇 , 郭嘉为例，通过编程，理论分析与定性相结合，有效而快速的计算出武将存活的量化评分，分别为：

摸牌型	变幻型	进攻型	防守型	卖血型
甄姬 5.62	周泰 1.04	马超 1.68	夏侯惇 1.19	郭嘉 3.36
陆逊 3.55	张角 2.55			

进而绘制出存活排名顺序图，并与网上统计的胜率图进行对比，分析模型的科学性，并根据模型来改进游戏的不合理性，得出最优化值。

关键词：三国杀；武将存活概率；概率分析理论

Background

A brief introduction of the game "Legends of the Three Kingdoms"

"Legends of the Three Kingdoms" is one of the most popular card games in China. Because the game players can act as one of his favorite generals in the novel of the Three Kingdoms, it is popular with many middle-school students. Players in the game are classified into Lord, Loyal, Insurgent, and Spy. At the beginning of the game, every player will be assigned a special role randomly, which decides the direction of playing the card. There are 108 game cards[1–2] which can be divided into Diamond, Heart, Spade, and Club and each contains 27 cards. Thus, there are 54 black ones and 54 red ones. Only one digit appears on one card. The digits are from one to thirteen, and eight cards for each digit. Four extra cards, which are *Ice Sword*, *Justice Shield*, *Flawless Defense*, and *Lightning*, are included (Table 1).

The game cards can be divided into Basic Cards, Equipment Cards, and Strategy Cards (Table 1). Each group can be subdivided into various cards with unique usage. Due to different skills of distinct generals and unique usage of cards, the players must act strategically (the basic rules of the game is shown in Appendix). However, quantities of random events, such as the possibility of survival and expectation of generals and the success of specific skill, arise from it. Thus, many interesting and profound mathematic problems are embedded in this game, from which the players get sufficient enjoyment.

Table 1. Game cards in “Legends of the Three Kingdoms”.

Basic Card (53*)	*Black Slash* (21)	*Red Slash* (9)
	Dodge (15)	*Peach* (8)
Strategy Card (36)	*Sabotage* (6)	*Drown in Happiness* (3)
	Theft (5)	*Murder with Borrowed Weapon* (2)
	All Out of None (4)	*Harvest* (2)
	Flawless Defense (4)	*Lightning* (2)
	South Invasion (3)	*Oath in Peach Garden* (1)
	Dual (3)	*Arrow Rain* (1)
Equipment Card (19)	*Kylin Bow* (1)	*Ice Sword* (1)
	Triple Halberd (1)	*ZhuGe Crossbow* (2)
	Rock Axe (1)	*Red Offensive Horse* (1)
	Dragon Broadsword (1)	*Black Offensive Horse* (2)
	Snake Spear (1)	*Red Defensive Horse* (2)
	TsingGang Sword (1)	*Black Defensive Horse* (1)
	Couple Swords (1)	*BaGua Rank* (2)
	Justice Shield (1)	

* The number of each kind of cards is indicated in bracket.

The aim of this study

The generals’ skills can be divided into 6 types, which are attacking, defense, blood-selling, assistance, card-drawing, and changing. The power of the last two skills is dependent on luck to some extent. Actually, “luck” is the probability which the producer has designed, either intentionally or accidentally. In the game, we wanted to construct a mathematic model to identify the generals’ powers. Therefore, in the present study, seven typical generals, who are Zhou Tai, Zhang Jiao, Zhen Ji, Lu Xun, Ma Chao, Xiahou Dun, and Guo Jia were selected to compare their abilities. The probabilities and expectations of the generals’ survival and the success of performed skills were analyzed, and the power of generals was scored. We hope the results would benefit players in choosing generals logically.

The Probability Analysis Model

At the beginning of the study, the special skills of several generals in the game “Legends of the Three Kingdoms” were classified and some representative generals were selected for further analysis. Schematic illustration of the strategy of this study is as shown in Figure 1.

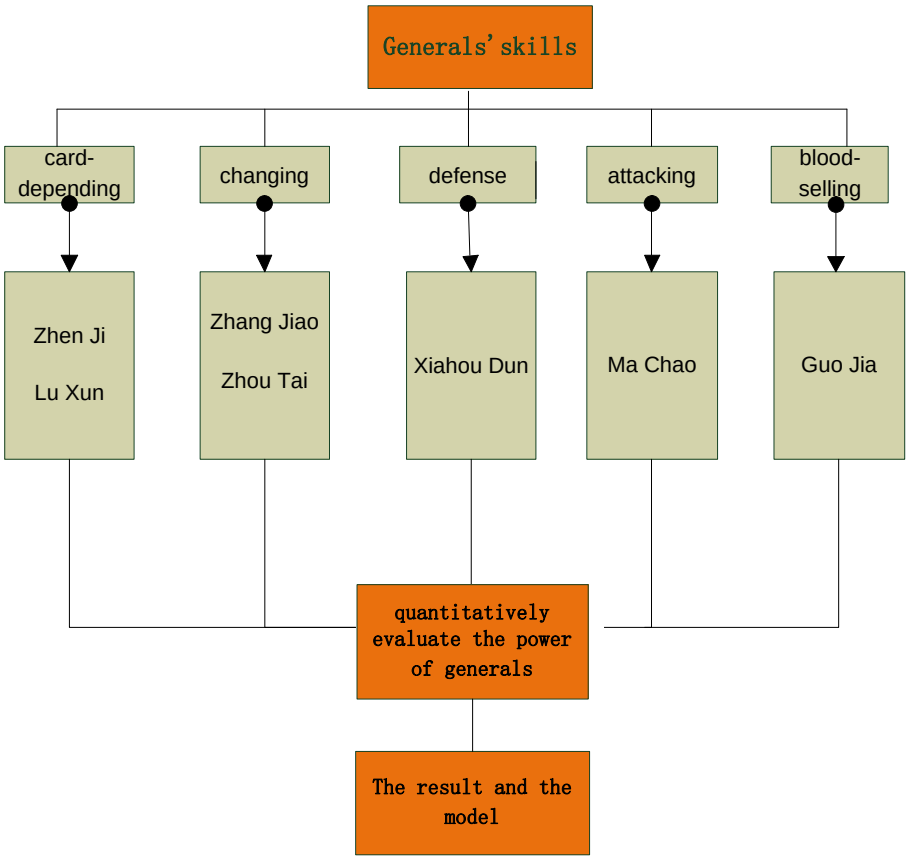

Figure 1. Schematic illustration of the strategy of this study.

Symbols in this study are defined as follows:

A	arrrangement	C	combination
n	survival times	E	mathematical expectation
P	probability	K	the amount of obtained card
λ	parameter of Poisson distribution	b	basic score
M	the score of general’s skills	S(i)	general’s total score

The following formulas are used in this study.

Arithmetic mean[3]:

$$\bar{P} = \frac{1}{n}\sum_{i=1}^{n} p(i) \quad . \tag{1.1}$$

Variance and standard deviation[3]:

$$S^2 = \frac{1}{n}\sum_{i=1}^{n} (P(i) - \bar{P})^2 \quad . \tag{1.2}$$

$$S = \sqrt{\frac{1}{n}\sum_{i=1}^{n} (P(i) - \bar{P})^2} \quad . \tag{1.3}$$

Goodness of fit[4]:

$$R^2 = 1 - \frac{\sum_{i=1}^{n} (y_i - \hat{y}_i)^2}{\sum_{i=1}^{n} (y_i - \bar{y})^2} \quad . \tag{1.4}$$

Poisson distribution[4]:

$$P(X = k) = \frac{e^{-\lambda}\lambda^k}{k!} \quad . \tag{1.5}$$

The general Zhou Tai, Zhang Jiao, Zhen Ji, and Lu Xun were selected and the probabilities for successful performance of their skills were estimated as follows.

Zhou Tai

Unique skill of the character:

Never Surrender [1–2]: When Zhou Tai is attacked by enemies and his health point is 0 or lower, he is dying. However, he can use his skill *Never Surrender* to draw one card from the card pile. If the digit on the card is different from any cards drawn previously, he won't die.

Example: When Zhou Tai's health point is 0, he performs *Never Surrender* for the first time. He will draw one card with a digit. For example, the digit is 3. Zhou Tai does not die and continues playing. When he is attacked again and his health point is 0, he can carry out the skill a second time. If the digit on the second card is 5, Zhou Tai survives again. When the health point of Zhou Tai is 0 for the third time, he can use the skill again. If the card drawn has the digit of 3 or 5, which is the same as the digit in the previous card, he will die.

In order to facilitate our analysis, we ignored the 4 extra cards. The probability for the survival when Zhou Tai performs the skill at an indicated time are analyzed as follows.

The 1st survival probability:

$$P_1 = 1. \tag{1.6}$$

The 2nd survival probability:

$$P_2 = 1 - \frac{7}{107} = \frac{100}{107}. \tag{1.7}$$

The 3rd survival probability:

$$P_3 = 1 - \frac{7 \times 2}{108 - 2} = \frac{92}{106}. \tag{1.8}$$

The n-th survival probability:

$$P_n = 1 - \frac{7(n-1)}{108 - (n-1)} \qquad (1 \le n \le 13, n \in \mathbb{N}^*). \tag{1.9}$$

The 14th survival probability:

$$P_{14} = 0. \tag{1.10}$$

Assume that the survival time is n, n=1, 2,3,…13, then,

$$P(n=1) = P_1(1 - P_2), \tag{1.11}$$

$$P(n=2) = P_1 P_2 (1 - P_3), \tag{1.12}$$

.....

$$P(n=k) = P_1 P_2 \cdots P_k (1 - P_{k+1}), 1 \le k \le 13, k \in \mathbb{N}^*. \tag{1.13}$$

It means that Zhou Tai survives from the 1st to the k-th time and dies in the k+1-th time.

We wrote a program to run the above calculation, which is shown below.

```
program zhoutai;
var k,n,m:longint;
      i,j:extended;
      s:extended;
begin
      while k<13 do
      begin
         inc(k);
          for n:=1 to k-1 do
             begin
               i:=i*(108-n);
               j:=j*(108-n-7*n);
             end;
         i:=i*(108-k);
         j:=j*(7*k);
         writeln(k,'       ',j:0:0,'/',i:0:0,' = ',j/i:0:5);
         s:=s+j/i*k;
         i:=1;
         j:=1;
      end;
      writeln('EX=',s:0:5);

End.
```

The output is shown in Table 2.

Table 2. The distribution of the survival times.

n	p	n	p
1	0.06542	8	0.05310
2	0.12344	9	0.02655
3	0.16223	10	0.01084
4	0.17471	11	0.00344
5	0.16114	12	0.00078
6	0.12891	13	0.00011
7	0.08934		

Thus, the mathematical expectation of survival times when Zhou Tai performs the skill *Never Surrender* is:

$$E(n) = \sum_{i=1}^{13} iP(n=i) = 4.52312. \qquad (1.14)$$

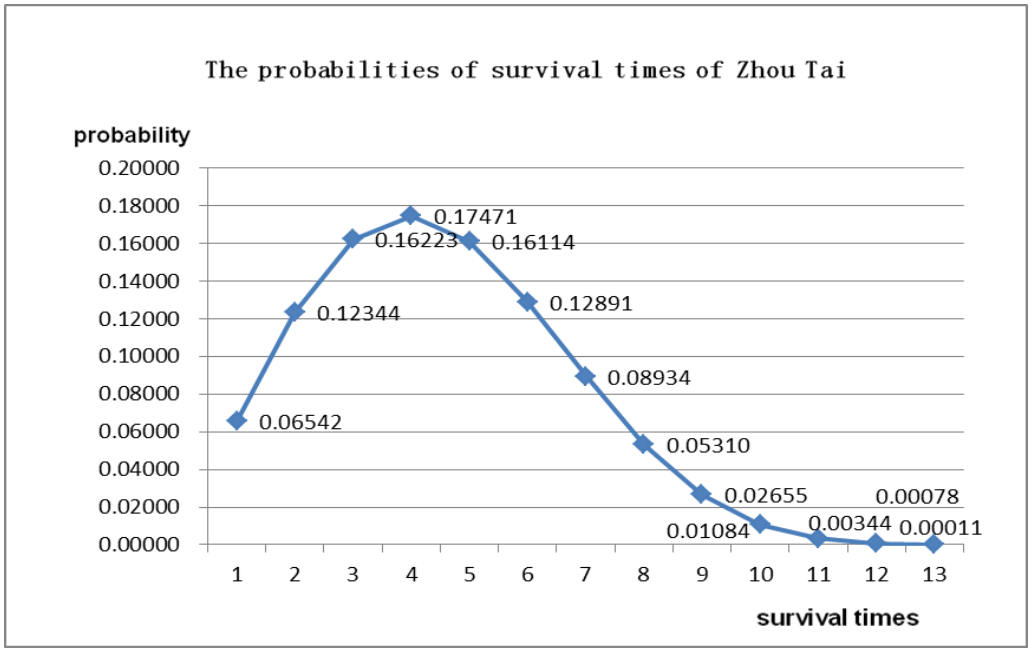

Figure 2. The survival probabilities at different times when Zhou Tai performs the skill *Never Surrender*.

As shown in Figure 2，the biggest survival probability of Zhou Tai is at the 4th time. The survival probability rises before it, and drops after it. The variance is 4.58295, which is similar to the mathematical expectation and can be displayed as a Poisson distribution.

For convenience, the formula of Poisson distribution is rewritten below:

$$P(X=k)=\frac{e^{-\lambda}\lambda^{k}}{k!}. \qquad (1.15)$$

If λ=E (mathematical expectation) = 4.52312 or λ=D (variance) = 4.58295, the output from the formula is similar to that from the program (Table 3 and Figure 3).

Table3. The Poisson distribution and the theoretical results.

n	λ=E	λ=D	Theoretical	n	λ=E	λ=D	Theoretical
1	0.04910	0.04686	0.06542	8	0.04716	0.04935	0.05310
2	0.11104	0.10738	0.12344	9	0.02370	0.02513	0.02655
3	0.16742	0.16403	0.16223	10	0.01072	0.01152	0.01084
4	0.18931	0.18794	0.17471	11	0.00441	0.00480	0.00344
5	0.17125	0.17226	0.16114	12	0.00166	0.00183	0.00078
6	0.12910	0.13158	0.12891	13	0.00058	0.00065	0.00011
7	0.08342	0.08615	0.08934				

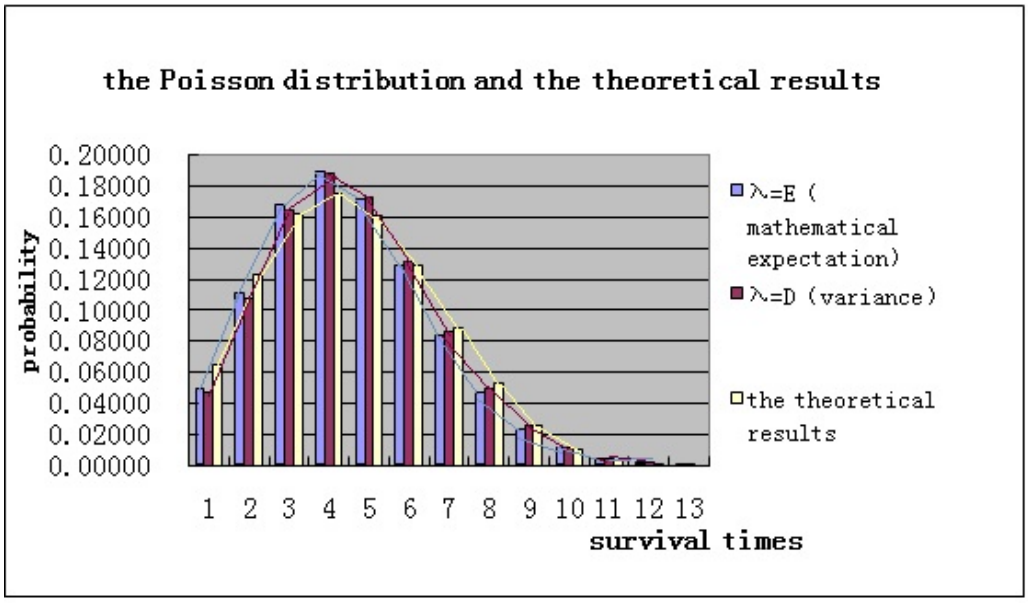

Figure 3. Comparison of the three outputs.

To analyze the fitting effect of the Poisson distribution, the goodness of fit is calculated as follows:

When λ=D=4.58295，

$$R_1^2 = 1 - \frac{\sum_{i=1}^{n}(y_i - \hat{y}_i)^2}{\sum_{i=1}^{n}(y_i - \bar{y})^2} = 1 - \frac{0.00094166}{0.05365475} \approx 0.98244958. \quad (1.16)$$

When λ=E=4.52312，

$$R_2^2 = 1 - \frac{\sum_{i=1}^{n}(y_i - \hat{y}_i)^2}{\sum_{i=1}^{n}(y_i - \bar{y})^2} = 1 - \frac{0.00084281}{0.05365475} \approx 0.98429066. \quad (1.17)$$

Therefore, the fitting effect is great.

Zhang Jiao

Unique skill of the character:

Thunder [2] : When Zhang Jiao uses a *Dodge*, he can point to one character, and reveals the top card of the card pile and this card is named Judge Card. If the Judge Card is a Spade, the character will lose 2 health points.

Ghost Road: Zhang Jiao can replace a Judge Card with a black card on his hand.

Example: If Zhang Jiao has *Dodge* on his hands and others use *Slash* to attack him, he uses a *Dodge* to perform *Thunder*. If the Judge Card is a Spade, the character assigned by Zhang Jiao loses 2 health points. If the Judge Card is not a spade and Zhang Jiao does not have any Spade and the *Thunder* will fail. However, if Zhang Jiao has a spade card in his hand, he can replace the Judge Card with his spade to let *Thunder* succeed.

Below is the probability of successful performance of *Thunder* in the first round in the new version of 1v1 (to start, each character has 3 cards in his hand).

There are two cases.

Case A: Zhang Jiao has *Dodge* but not a Spade.

Among 108 cards, there are 15 *Dodge* cards, 27 spade cards and 66 neither *Dodge* nor spade cards. There are three independent events.

1. Zhang Jiao has 1 *Dodge* and 2 neither *Dodge* nor spade cards. This comes to the total cases of $C_{15}^{1}C_{66}^{2}$.

2. Zhang Jiao has 2 *Dodge* and 1 neither *Dodge* nor spade card. This comes to the total cases of $C_{15}^{2}C_{66}^{1}$.

3. Zhang Jiao has 3 *Dodge*. This comes to the total cases of C_{15}^{3}.

Because the number of total cases is C_{108}^{3}, the probability of showing a spade card from the card pile is $\frac{1}{4}$, then,

$$P(A)=\frac{C_{15}^{1}C_{66}^{2}+C_{15}^{2}C_{66}^{1}+C_{15}^{3}}{C_{108}^{3}}\times\frac{1}{4}\approx 0.04844. \qquad (1.18)$$

Case B: Zhang Jiao has both *Dodge* and spade.

1. Zhang Jiao has 1 *Dodge*, 1 spade, and 1 card of neither *Dodge* nor spade. This comes to the total cases of $C_{15}^{1}C_{27}^{1}C_{66}^{1}$.

2. Zhang Jiao has 1 *Dodge* and 2 spades. This comes to the total cases of $C_{15}^{1}C_{27}^{2}$.

3. Zhang Jiao has 2 Dodge, 1 spade. This comes to the total cases of $C_{15}^{2}C_{27}^{1}$, then,

$$P(B)=\frac{C_{15}^{1}C_{27}^{1}C_{66}^{1}+C_{15}^{1}C_{27}^{2}+C_{15}^{2}C_{27}^{1}}{C_{108}^{3}}\approx 0.17060. \qquad (1.19)$$

Therefore, the probability of successful performance of *Thunder* is:

$$P=P(A)+P(B)\approx 0.04844+0.17060=0.21904. \qquad (1.20)$$

Zhen Ji

Unique skill of the character:

Beauty to give up all: Zhen Ji can treat Spade or Club hand card as Dodge.

Goddess of Water: At the beginning phase, she can judge. If the Judge Card is Club or Spade, she gets it. Moreover, she can use the skill again. But if the Judge Card is Diamond or Heart, she cannot.

Example: at the beginning of a round, she can perform *Goddess of Water*, and then reveal a Judge Card from the card pile. If the first Judge Card is black, she gets it. If the second Judge Card is black, she also gets it. If the third Judge Card is red, she cannot take a new card and the skill ends.

In this way, she can sometimes be powerful to gain a lot of black cards. If we know the probability of the skill, we can calculate the mathematical expectation of the obtained cards.

If Zhen Ji gets k cards via the performance of *Goddess of Water*, there must be k black cards on the top of the card pile, and the [k+1]-th card to the top must be red. There are 54 red cards and 54 black cards in the card pile.

Therefore, for the top k cards have an arrangement of A_{54}^{k}. For the k+1th card, it has an arrangement of A_{54}^{1}. The total arrangement is A_{108}^{k+1}. Above all, the probability of getting k cards by *Goddess of Water* is:

$$P(k)=\frac{A_{54}^{k}A_{54}^{1}}{A_{108}^{k+1}}. \qquad (1.21)$$

We wrote a program to calculate the probabilities of obtained cards by *Goddess of Water*, which is shown below.

```
program zhenji;
var k:longint;
      x,y,p,w:extended;
function pailie(a,b:longint):extended;
var i:longint;
      g:extended;
begin
    g:=1;
       for i:=b    downto b-a+1 do
          g:=g*i;
          pailie:=g;
end;
begin
      assign(output,'output.txt');
      rewrite(output);
      w:=0;
       for k:=1 to 17 do
         begin
               x:=pailie(k,54)*pailie(1,54);
               y:=pailie(k+1,108);
               p:=x/y;
               w:=w+k*p;
               writeln('P',k,'=',x:0:0,'/',y:0:0,'=',p:0:5);
               writeln;
         end;
         writeln('Ew=',W:0:5);
         close(output);
end.
```

The probabilities of obtained cards are indicated in Table 4 and Figure 4.

Table 4: The distribution of obtained cards by *Goddess of Water.*

n	p	n	P
0	0.50000	9	0.00074
1	0.25234	10	0.00034
2	0.12617	11	0.00015
3	0.06248	12	0.00007
4	0.03064	13	0.00003
5	0.01487	14	0.00001
6	0.00715	15	0.00001
7	0.00340	16	0.00000
8	0.00160	17	0.00000

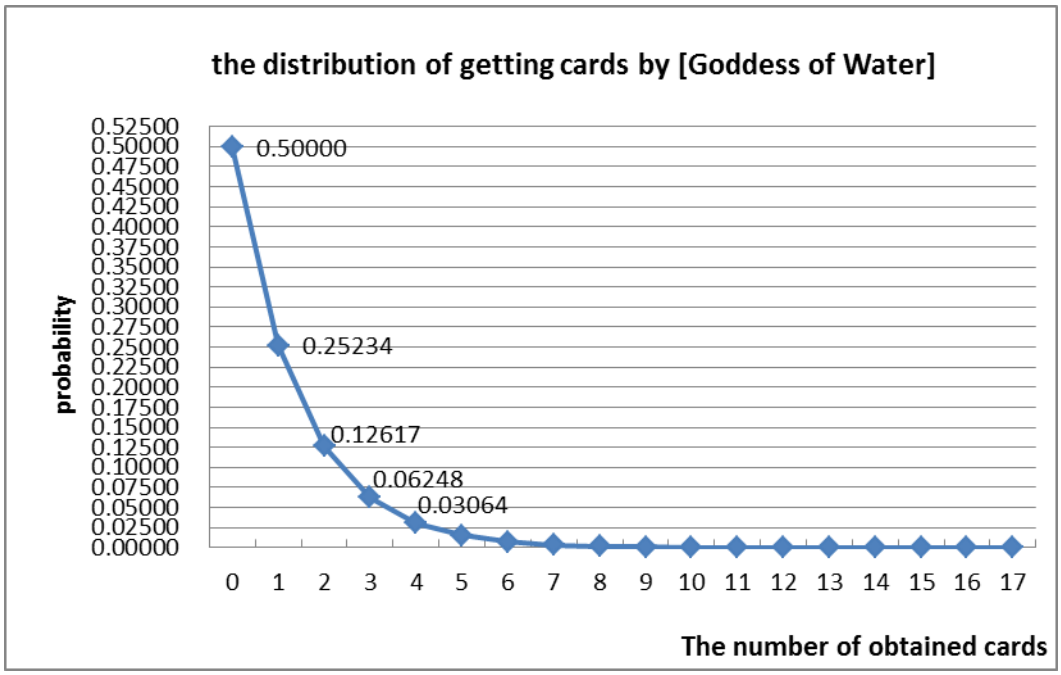

Figure 4. The distribution of obtained cards by *Goddess of Water*.

As shown in Figure 4, the success rate after 17th [Goddess of Water] is very low. To facilitate calculation, the outputs from 1st to 17th were used to calculate the mathematical expectation.

The mathematical expectation is

$$E(k)=\sum_{i=1}^{17} iP(i)=0.98181. \qquad (1.22)$$

Lu Xun

Unique skills of the character:

Modesty: Lu Xun cannot be the target of *Theft* and *Drown in Happiness*.

Continuous Attack: Once the last card in his hand is lost, he draws a card.

Assuming that Lu Xun has 1 card, he uses it and then performs the skill *Continuous Attack* to obtain a card from the top of the card pile. In the game, the *Dodge*, *Flawless Defense*, and some cards are passivity cards, which cannot be used in his own round, so if he obtains such cards, the *Continuous Attack* is over. On the other hand, the initiative cards such as *Sabotage* make the skill go forward.

If Lu Xun obtains the card *All Out of None*, he can obtain 3 cards (one by *Continuous Attack*, two by *All Out of None*). Because of the 3 extra cards, *Continuous Attack* is over.

In addition, based on the game rule, one character can use only one *Slash* in a round. But if one is equipped with the weapon *ZhuGe Crossbow*, he can use *Slash* without limits.

Therefore, two cases are discussed here.

Case A: Lu Xun is not equipped with *ZhuGe Crossbow.*

Case B: Lu Xun is equipped with *ZhuGe Crossbow.*

Case A:

1. In the k times of *Continuous Attack*, Lu Xun obtains neither *All Out of None* nor *ZhuGe Crossbow*.

The k cards on the top of the card pile which Lu Xun may obtain come from 17 Equipment Cards (except *ZhuGe Crossbow*) and 28 Strategy Cards (except *All Out of None* and *Flawless Defense*). The k+1th card must be one of the 53 Basic Cards and 4 *Flawless Defense*.

The arrangement of the k cards is A_{17+28}^{k}. The arrangement of the k+1th card is A_{53+4}^{1}. The total arrangement of is A_{108}^{k+1}.

Thus, the probability of the k cards is

$$P_1(k)=\frac{A_{17+28}^{k}A_{53+4}^{1}}{A_{108}^{k+1}}=\frac{57A_{45}^{k}}{A_{108}^{k+1}}. \qquad (1.23)$$

2. Lu Xun obtains an *All Out of None* at the k+1 time.

The k cards come from 17 Equipment Cards (except *ZhuGe Crossbow*) and 28 Strategy Cards (except *All Out of None* and *Flawless Defense*). The k+1th card must be one of the 4 *All Out of None*.

Because of the *All Out of None*, Lu Xun can obtain 2 extra cards. Thus, Lu Xun obtains k+2 cards in total. The probability is

$$P_2(k)=\frac{A_{17+28}^{k}A_{4}^{1}}{A_{108}^{k+1}}=\frac{4A_{45}^{k}}{A_{108}^{k+1}}. \qquad (1.24)$$

Case B:

3. Lu Xun doesn't obtain *All Out of None* in the k times.

The k cards come from 8 equipment cards (except weapon cards), 26 Strategy Cards (except *All Out of None*, *Flawless Defense*, and *Murder with Borrowed Weapon*), and 30 *Slash*. The k+1-th card must be one of the 8 Weapon cards, 4 *Flawless Defense*, 2 *Murder with Borrowed Weapon* and 23 Basic cards (except *Slash*). Thus, the probability is

$$P_3(k) = \frac{A_{8+26+30}^{k} A_{8+4+2+23}^{1}}{A_{107}^{k+1}} = \frac{37 A_{64}^{k}}{A_{107}^{k+1}}. \qquad (1.25)$$

4. Lu Xun obtains the *All Out of None* at the k+1 time

The k cards come from 8 equipment cards (except weapon cards), 26 Strategy Cards (except for *All Out of None*, *Flawless Defense*, and *Murder with Borrowed Weapon*), and 30 *Slash*. The K+1 card must be one of the 4 *All Out of None*, which let Lu Xun obtain 2 extra cards. Thus, the probability is

$$P_4(k) = \frac{A_{8+26+30}^{k} A_{4}^{1}}{A_{107}^{k+1}} = \frac{4 A_{64}^{k}}{A_{107}^{k+1}}. \qquad (1.26)$$

We wrote a program to calculate the probabilities of obtained cards by *Continuous Attack*, which is shown in Appendix.

All the data can be showed in the Table 5 and Figure 5.

Table 5. The output of the program.

k	P1	P2	P3	P4	**k**	P1	P2	P3	P4
1	0.22196	0.01558	0.20878	0.02257	**6**	0.00238	0.00017	0.01520	0.00164
2	0.09214	0.00647	0.12527	0.01354	**7**	0.00092	0.00006	0.00881	0.00095
3	0.03773	0.00265	0.07468	0.00807	**8**	0.00035	0.00002	0.00508	0.00055
4	0.01524	0.00107	0.04423	0.00478	**9**	0.00013	0.00001	0.00290	0.00031
5	0.00607	0.00043	0.02602	0.00281	**10**	0.00005	0.00000	0.00164	0.00018

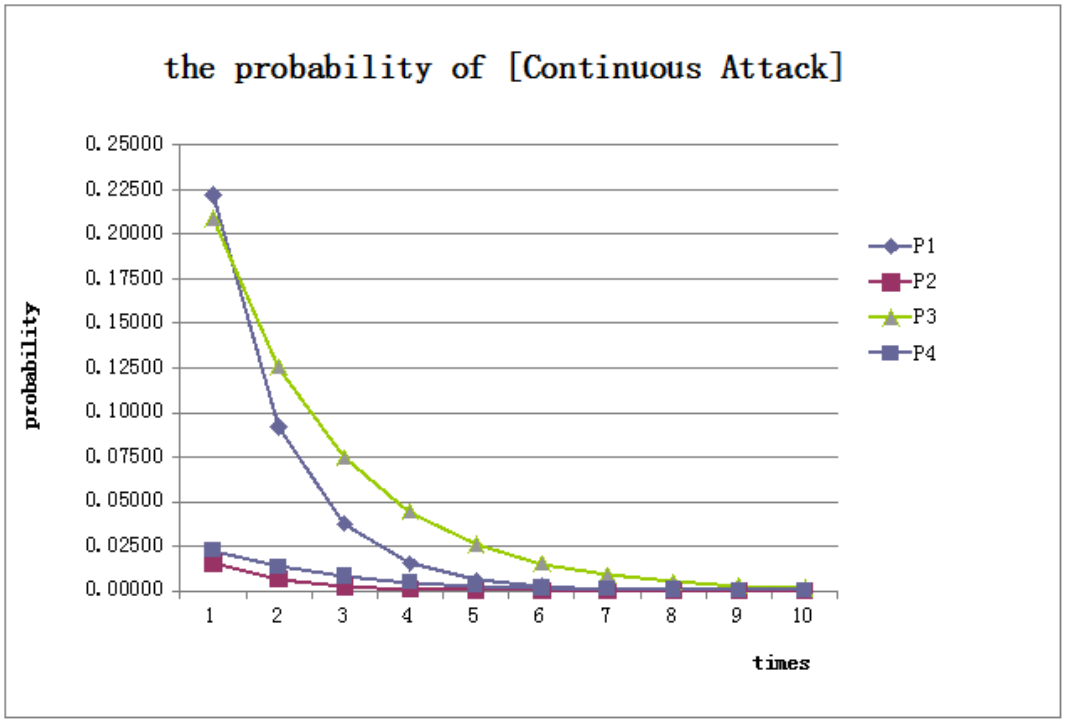

Figure 5. The probability of *Continuous Attack.*

As shown in Figure 5, when k=10, the probability is very low. Thus, the outputs from 1st to 10th were used to calculate the mathematical expectation. The results are as follows:

When Lu Xun is not equipped with *ZhuGe Crossbow*, the mathematical expectation of the times of *Continuous Attack* is

$$W(A)=\sum_{i=1}^{10} iP_1(i)+\sum_{i=1}^{10}(i+2)P_2(i)=0.73338. \qquad (1.27)$$

When Lu Xun is equipped with *ZhuGe Crossbow*, the mathematical expectation of the times of *Continuous Attack* is

$$W(B)=\sum_{i=1}^{10} iP_3(i)+\sum_{i=1}^{10}(i+2)P_4(i)=1.46980. \qquad (1.28)$$

Construction of a model to quantitatively evaluate the power of Generals

Generally, the generals with more power are favored by players. Thus, we figured out a model to quantitatively evaluate the generals' abilities in this study.

The standard of generals' abilities quantitative score model

Each general was defined a score designated as 'S' value according to the rules listed below. The higher score one gets, the more powerful he/she is.

- If one obtains an extra card in one round, 1 point is added to one's 'S' value.
- If one lets another lose 1 health point, 2 points are added to one's 'S' value.
- If one saves 1 health point by using his special skill to defense other's attack every time, 2 points are added to one's 'S' value.
- If one can survive to an extra round, a 'basic score' is added to one's 'S' value. The 'basic score' will be defined below.

Every general gets 2 game cards at the beginning of each round. Here, the game cards are divided into two groups. The cards which can endow general the attacking ability are in 'A' group, including *Slash*, *Sabotage*, *Theft*, *All Out of None*, *South Invasion*, *Arrow Rain*, and *Duel*, and the number of this group is 52. The cards which cannot endow general the attacking ability were in 'B' group, including *Dodge*, *Peach*, *Flawless Defense*, *Drown in Happiness*, *Murder with Borrowed Weapon*, *Harvest*, *Lightning*, and *Oath in Peach Garden*, and the number of this group is 56. To simplify the complexity of the power within the various 'A' or 'B' cards, we consider an 'A' card can offset the effect of a 'B' card, and the 'B' card can't hurt others. If one make another lose 1 health point by using an 'A' card, 2 points are added to one's 'S' value.

Construction of the model[5-6]

Suppose in n rounds, a player gets 2n cards which consist of p 'A' cards and 2n-p 'B' cards; the opponent gets 2n cards which consist of q 'A' cards and 2n-q 'B' cards.

Here, $p,q \in [0,2n], n \in N^*, p,q \in N$.

If $p > 2n-q$, the player would hurt the opponent. And the number of health points which the opponent loses is

$$p-(2n-q)=p+q-2n .$$

Thus, the 'S' score of the player is added by

$$2(p+q-2n) .$$

In n rounds, the probability of such event is

$$P(n,p,q)=\frac{C_{52}^{p}C_{56}^{2n-p}}{C_{108}^{2n}}\times\frac{C_{52}^{q}C_{56}^{2n-q}}{C_{108}^{2n}} . \quad (2.1)$$

If a general doesn't have any skills, his scores would be

$$S_0(n,p,q)=(\frac{C_{52}^{p}C_{56}^{2n-p}}{C_{108}^{2n}}\times\frac{C_{52}^{q}C_{56}^{2n-q}}{C_{108}^{2n}})\times 2\times(p+q-2n) . \quad (2.2)$$

Suppose M(n) is the scores derived from a generals' skill, his final score is

$$S=S_0(n,p,q)+M(n) . \quad (2.3)$$

Standardization of the generals' scores

To normalize the generals' scores, a 'basic score', which is the average points a general can get by fighting with others in one round, was defined. That is when n=1, the general's score is

$$S_0(1,p,q), \quad p+q>2n=2, p,q \in [0,2] . \quad (2.4)$$

There are three independent events, which are

$p=1,q=2$; $p=2,q=1$; $p=2,q=2$. Thus,

$$S_0(1,1,2)=(\frac{C_{52}^1C_{56}^1}{C_{108}^2}\times\frac{C_{52}^2}{C_{108}^2})\times 2\times(1+2-2)\approx 0.232. \quad (2.5)$$

$$S_0(1,2,1)=(\frac{C_{52}^2}{C_{108}^2}\times\frac{C_{52}^1C_{56}^1}{C_{108}^2})\times 2\times(1+2-2)\approx 0.232. \quad (2.6)$$

$$S_0(1,2,2)=(\frac{C_{52}^2}{C_{108}^2}\times\frac{C_{52}^2}{C_{108}^2})\times 2\times(2+2-2)\approx 0.212. \quad (2.7)$$

Thus, the 'basic score' is

$$b=S_0(1,1,2)+S_0(1,2,1)+S_0(1,2,2)\approx 0.68. \quad (2.8)$$

The quantitative calculation of card-drawing type

Seven representative generals were selected to calculate their scores according to the model mentioned above.

1. Zhen Ji

Unique skill of the character:

Beauty to give up all: Zhen Ji can treat Spade or Club hand card as *Dodge*. Generally speaking, the attack will cause the loss of 1 health point, which is equal to 2 points.

At the beginning of each round, the expectation of getting a black card is 1. In addition, as mentioned above, the unique skill *Goddess of Water* of Zhen Ji would add 0.98 black card. So, the sum of black cards is $1+0.98=1.98$, the score is $1.98\times 2=3.96$ points.

The performance of *Goddess of Water* would get extra 0.98 cards as expected, thus getting score of 0.98. Therefore,

$$M(ZhenJi)=3.96+0.98=4.94. \quad (2.9)$$

Taken together,

$$S(ZhenJi)=b+M(ZhenJi)=5.62. \quad (2.10)$$

2. Lu Xun

Unique skill of the character:

Modesty: Lu Xun cannot be the target of *Theft* and *Drown in Happiness.*

Here the damage of Lu Xun is calculated if he doesn't have the skill *Modesty*, thus

1, He is the target of *Theft*. There are two independent events for this case.

Event A. Lu Xun is the target of *Theft* once and loses one card. Then he is very easy to hurt. The probability of Event A is

$$P(A)=\frac{5}{108}\times\frac{103}{107}+\frac{103}{108}\times\frac{5}{107}\approx 0.089. \qquad (2.11)$$

Because 1+2=3 points are added, the scores are $0.089+0.089\times 2=0.267$.

Event B, Lu Xun is the target of *Theft* twice and loses 2 cards. The probability of Event B is

$$P(B)=\frac{5}{108}\times\frac{4}{107}\approx 0.002. \qquad (2.12)$$

Because 2+2=4 points are added, the score is $0.002\times 2+0.002\times 2=0.008$.

Thus, the score for the target of *Theft* is equal to $0.267+0.008=0.275$.

2, He is the target of *Drown in Happiness*, which forbids him to bid 2 cards.

If the opponent side has *Drown in Happiness*, which is designated as Event A, the probability of Event A is

$$P(A)=1-\frac{105}{108}\times\frac{104}{107}\approx 0.055. \qquad (2.13)$$

The score is $0.055\times 2=0.11$.

Thus, the total score of the skill *Modesty* is $0.11+0.275=0.286$.

Continuous Attack

Each card obtained by the skill *Continuous Attack* can be used to hurt an opponent, which gets 2 points. The probability when he is equipped with *ZhuGe Crossbow.*

$$P(A)=1-\frac{106}{108}\times\frac{105}{107}\approx 0.037. \quad (2.14)$$

The extra cards got by using *ZhuGe Crossbow* are $0.037\times 1.46980\approx 0.054$.

Thus, the scores is added by $0.054\times 2=0.108$.

If he isn't equipped with *ZhuGe Crossbow*, which can acquire 0.73338 cards, the scores are added by $0.73338\times 2\approx 1.47$.

If he cannot continue to use the skill, the cards previously obtained may not be used. The probability of those cards having *Dodge* or *Flawless Defense* is:

$$\mathrm{P}=\frac{19}{57}\approx 0.333. \quad (2.15)$$

At this time, one of those cards can be used as an 'attacking-card', and gets an extra card. Thus, the scores are added by $0.333\times(2+1)=1$.

This skill is equal to $0.108+1.47+1\approx 2.58$. Therefore,

$$M(LuXun)=0.286+2.58\approx 2.87. \quad (2.16)$$

Taken together,

$$\mathrm{S}(LuXun)=b+M(LuXun)=3.55. \quad (2.17)$$

3. Zhou Tai

As calculated above, the mathematical expectation upon the performance of the skill *Never Surrender* is 4.52, which results in extra 4.52 health points. Meanwhile, he has 4 health points. Thus,

$$M(ZhouTai)=\frac{4.52b}{4.52+4}\approx 0.36. \quad (2.18)$$

$$\mathrm{S}(ZhouTai)=M(ZhouTai)+b=1.04. \quad (2.19)$$

4. Zhang Jiao

As calculated above, the successful probability of performing the skill *Thunder* is 0.218. Because the cards in his hands change unpredictably two round onwards, opponents would not kill him. But if he has only one health point and one hand card, opponents would attack him for lucky. The probability of success of skill *Thunder* is $\frac{1}{4}$ by using *Dodge*. Therefore his scores are mainly associated with the probability of *Thunder* success in first round with only one *Dodg*e. The *Thunder* can hurt an opponent 2 health points. Thus,

$$M(ZhangJiao)=0.218\times 2\times 2+\frac{1}{4}\times 2\times 2=1.872. \quad (2.20)$$

$$S(ZhangJiao)=M(ZhangJiao)+b=2.55. \quad (2.21)$$

5. Ma Chao

Unique skill of the character:

Cavalry attack: When Ma Chao assigns a target character with *Slash*, he can judge, if the result is Heart or Diamond, the *Slash* cannot be avoided by *Dodge*.

Because the sum of red cards and black cards in the card pile are roughly same, the probability of the judgment is about 0.5.

$$M(MaChao)=0.5\times 1\times 2=1. \quad (2.22)$$

$$S(MaChao)=b+M(MaChao)=1.68. \quad (2.23)$$

6. Xiahou Dun

Unique skill of the character:

Unyielding: Once Xiahou Dun gets hurt, he can make a judge, if the result is not Heart, then the one who hurts him needs to make a choice: discard 2 cards in his hand or get 1 point hurt by Xiahou Dun.

According to the definition of “basic score”, the probability of getting hurt from an opponent is the half of the “basic score”, that is 0.34. When Xiahou Dun shows a Judge Card of the card pile, the probability of being not Heart is 0.75. Then the opponent should discard 2 cards or lose 1 health point, which results in 2 scores for Xiahou Dun. Thus,

$$M(XiahouDun)=0.34\times 0.75\times 2=0.51. \tag{2.25}$$

$$\mathrm{S}(XiahouDun)=\mathrm{b}+M(XiahouDun)=1.19\ . \tag{2.26}$$

7. Guo Jia

Unique skill of the character:

God's envy: After your judge card took effect, you get the card.

Heritage: When Guo Jia gets 1 point hurt, he draws 2 cards from the top of the card pile and can give any number of the cards to any number of characters.

The skill *Heritage* can be regarded as an extra round. The score of drawing 2 cards is 2. An extra round can obtain a 'basic score' of 0.68. Thus,

$$M(GuoJia) = 2 + 0.68 = 2.68. \quad (2.27)$$

$$S(GuoJia) = b + M(GuoJia) = 3.36. \quad (2.28)$$

Comparison of the model output and the statistic results

To test the quality of the constructed model, the output of the model was compared to the statistic data recorded by players in the internet[1–2].

The representative generals' scores are listed in Table 6 and shown in Figure 6.

Table 6. The representative generals' scores from the model.

Card-drawing	Changing	Attacking	Defense	Blood-selling
Zhen Ji	Zhou Tai	Ma Chao	Xiahou Dun	Guo Jia
5.62	1.04	1.68	1.19	3.36
Lu Xun	Zhang Jiao			
3.55	2.55			

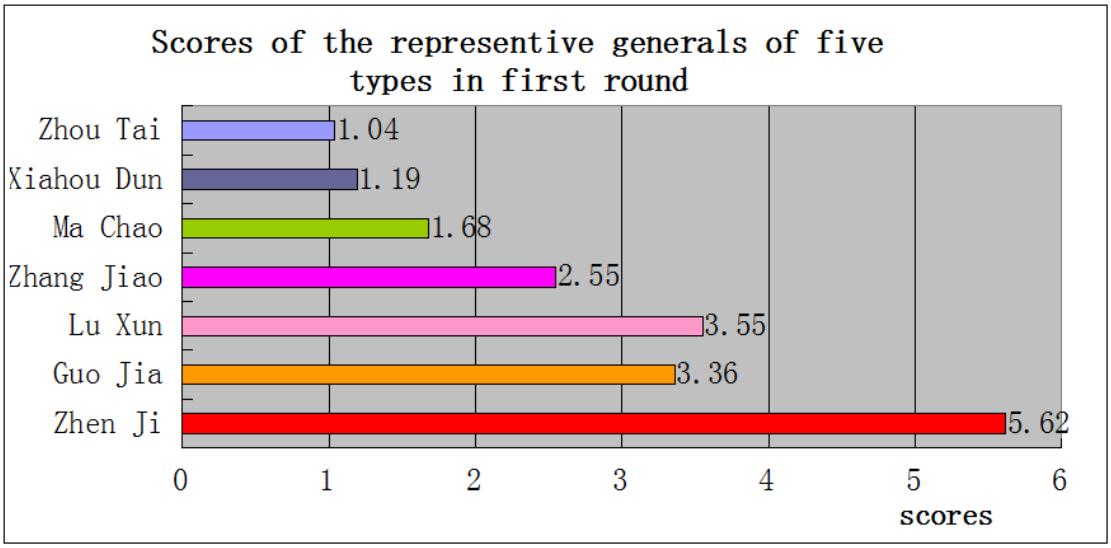

Figure 6. Schematic illustration of the model output.

Ranking：Zhen Ji > Lu Xun> Guo Jia > Zhang Jiao > Ma Chao > Xiahou Dun > Zhou Tai

The statistic data derived from real combat between two players running the 1V1 version (general random matching) is shown in Figure 7:

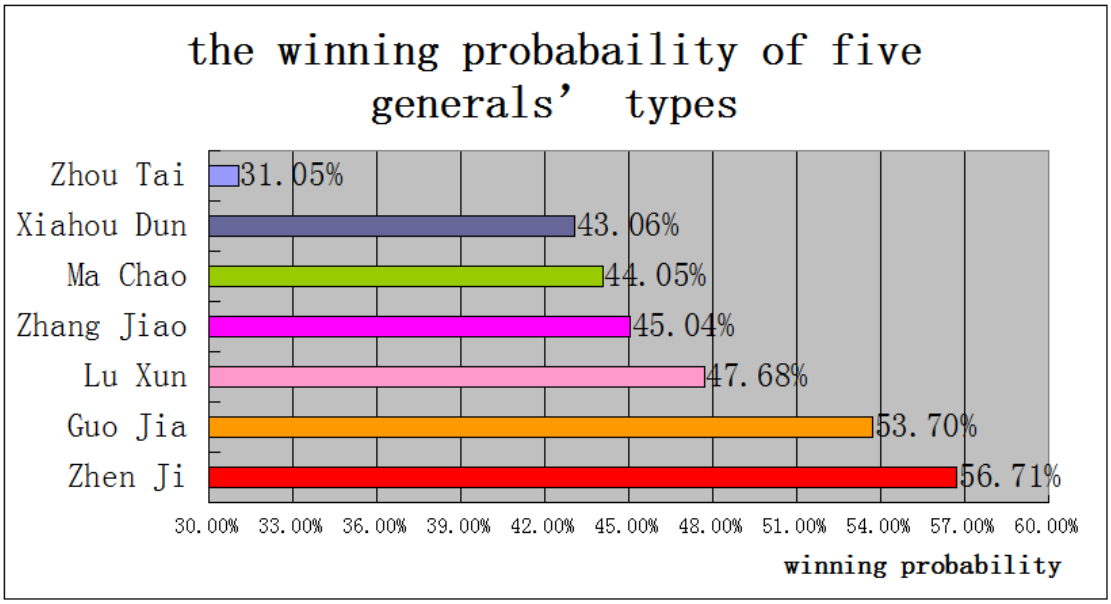

Figure 7. Schematic illustration of the statistic data.

Ranking: Zhen Ji > Guo Jia >Lu Xun > Zhang Jiao > Ma Chao > Xiahou Dun > Zhou Tai

The ranking from our model is very similar to that from the statistic data, except that the second and third place. There are some explanations.

Firstly, our model is a static theoretical one. We calculate the model by supposing that there are always 108 cards in the card pile. But the cards in the card pile is becoming fewer and fewer when we are playing the game, which is a dynamic process. So the errors are hard to avoid.

Secondly, although one general may restrain another, he may be restrained to the third one. Thus, in real defense, if one player chooses one general, opponent may choose a general who he thinks is good at fighting the first one.

Thirdly, the model is deigned based on the assumption that the general is fighting against another one without the unique skills and the influence by other general's unique skills is not under consideration.

Although the model has some bugs, its output reflects the true statistic data, which may provide references to players.

Discussion

In the present study, the probability of the success when several popular generals in the card game "Legends of the Three Kingdoms" perform their unique skill was analyzed. Later, a model was figured out to quantitatively evaluate several selected generals' abilities. The aim of our study is to reveal some hidden rules or some shortages designed by the producer, either intentionally or accidentally, and to let players know the winning ratio of the generals selected by themselves.

Recommendation to players

We divided generals into seven types according to their features. The output of our model shows different winning ratio among them. The generals of Type card-drawing are more powerful, with 57% winning ratio for Zhen Ji and 54% winning ratio for Guo Jia. The generals of Type changing are more faint, such as Zhou Tai with 31% winning ratio. As for the generals of Type attacking,

their winning ratio trends to decrease owing to their weak defensive abilities. Type defense ones become disadvantageous gradually in multiple rounds. Only Type blood-selling ones show balance and fairness in the game.

The game players can select generals referring to our results. For example, the expectation value for Zhen Ji to perform the skill *Goddess of Water* is about 0.98, indicating almost one extra card obtained in each round. Another general, Zhou Yu can draw one more card each round, and the expectation is 1. Actually, Zhen Ji is favorable to players because she is a kind of general depending on luck and sometimes she can gets ten cards by performing her unique skill. Although they have similar expectation, their variances are different. Here, the variance can be indicated as the instability of drawing cards. Generally speaking, if expectation value is equal to each other, the less the variance is, the more stable the random variable is, which implies the "outbreak" potential is not high. On the contrary, the more the variance is, the easier the "outbreak" is going to happen, which may result in an advantage during the game. This theory is mentioned in the teaching book of mathematics in high school. In a competition of shooting, for players with same record, the person with more variance has an opportunity to get a higher score. However, Zhen Ji sometimes has bad luck to get a red card at the beginning, so the number of extra card is zero, which players must face to.

Recommendation to the game designer

To make the game more exciting, we suggest that it’s better for the game designer to modify and balance some generals’ skills.

Zhou Tai can live 4.5 more times than others according to our calculation. However, this advantage is usually useless. Because he has no card in his hand when he performs the skill *Never Surrender*, it’s very easy for him to be attacked to die. We recommend that Zhou Tai can save one card or the digit on the card can repeat once upon the skill performance.

The skill *Continuous Attack* of Lu Xun is too powerful, as indicative of the second strongest general ranking by our model and statistic data. We recommend forbidding him to perform the skill in other's round.

As for the strongest general Zhen Ji who gets the highest score by our model, we recommend his unique skill *Beauty to give up all* can only be used for equipment cards.

As for Ma Chao, who is a prominent one of Type attacking, he is too deficient in defense. Thus, his score is 1.68 and sorts second to last. We recommend give him a defense skill, not being able to be the target of *Arrow rain* to make up for his shortage.

In summary, the irrationality of the card game "Legends of the Three Kingdoms" is identified in the present study. We think the game can be improved and an optimized value can be obtained according to the output of our constructed model.

References

1. **Baike, Baidu.** 2013. *Legends of the Three Kingdoms.* http://baike.baidu.com/subview/1147207/5949677.htm?fromId=1147207&from=rdtself.
2. **Tieba, Baidu.** 2013. *New board role-playing games (BRPG):Statistics of the winning ratio of generals in "Legends of the Three Kingdoms" Online 1v1.* http://tieba.baidu.com/p/2023664674.
3. **Department of Mathematics and Mechanics.** 1980. *Probability theory and mathematical statistics*. PP1-74. Higher Education Press, Beijing.
4. **Liu CH and Wang JP.** 2003. *Probability theory and mathematical statistics.* PP61-65. Press of Huazhong University of Science and Technology, Wuhan.
5. **Zhang DF et al.** 2010. *The MATLAB Probability and Mathematical Statistics Analysis*. China Machine Press, Beijing.
6. **Han ZG.** 2005. *Mathematical modelling and its application.* Higher Education Press, Beijing.

Appendix

The calculation programme and data output

Zhou Tai

Here is the pascal calculation progress and the results.

```
program zhoutai;
var k,n,m:longint;
      i,j:extended;
      s:extended;
begin
      assign(output,'output.txt');//
      rewrite(output);
      i:=1;//
      j:=1;//
      k:=0;//
      s:=0;//
      while k<13 do
      begin
         inc(k);
          for n:=1 to k-1 do
             begin
               i:=i*(108-n);
               j:=j*(108-n-7*n);
             end;
         i:=i*(108-k);
         j:=j*(7*k);
         writeln(k,'        ',j:0:0,'/',i:0:0,' = ',j/i:0:5); //
         s:=s+j/i*k;//
         i:=1;//
         j:=1;//
      end;
      writeln('EX=',s:0:5);//
      close(output);//
End.
1       7/107 = 0.06542
2       1400/11342 = 0.12344
3       193200/1190910 = 0.16223
4       21638400/123854640 = 0.17471
5       2055648000/12757027920 = 0.16114
6       167740876800/1301216847840 = 0.12891
7       11741861376000/131422901631840 = 0.08934
8       697802047488000/13142290163184000 = 0.05310
9       34541201350656000/1301086726155216000 = 0.02655
10      1381648054026240000/127506499163211170000 = 0.01084
11      4255476006400819200/12368130418831483000000 = 0.00344
12      928467492305633280000/11873405202078224000000000 = 0.00078
13      1326382131865190400000/11873405202078224000000000 = 0.00011
EX=4.52312
```

Zhen Ji

Here is the Pascal calculation progress and the results.

```
program zhenji;
var k:longint;
      x,y,p,w:extended;
function pailie(a,b:longint):extended;//
var i:longint;
      g:extended;
begin
     g:=1;
       for i:=b    downto b-a+1 do

          g:=g*i;
          pailie:=g;

end;

begin
      assign(output,'output.txt');//
      rewrite(output);
      w:=0;

       for k:=1 to 17 do         //
         begin
              x:=pailie(k,54)*pailie(1,54);    //molecular
              y:=pailie(k+1,108);      //denominator
              p:=x/y;
              w:=w+k*p;      //calculating the expectation
              writeln('P',k,'=',x:0:0,'/',y:0:0,'=',p:0:5);
              writeln;
         end;
         writeln('Ew=',W:0:5);//
         close(output);
end.
```

P1=2916/11556=0.25234

P2=154548/1224936=0.12617

P3=8036496/128618280=0.06248

P4=409861296/13376301120=0.03064

P5=20493064800/1377759015360=0.01487

P6=1004160175200/140531419566720=0.00715

P7=48199688409600/14193673376238720=0.00340

P8=2265385355251200/1419367337623872000=0.00160

P9=104207726341555200/140517366424763330000=0.00074

P10=468934768536998400/13770701909626806000000=0.00034

P11=2063312981562793000000/133575808523380020000000=0.00015

P12=8872245820720009700000/1282327761824448200000000000=0.00007

P13=372634324470240410000000/12182113737332258000000000000=0.00003

P14=1527800730327985700000000/1145118691309232200000000000000=0.00001

P15=611120292131194270000000000/106496038291758600000000000000000=0.00001

P16=2383369139311657700000000000/979763552284179100000000000000000000=0.00000

P17=9056802729384299100000000000000/891584832578602980000000000000000000000=0.00000

Ew=0.98181

Lu Xun

Here is the Pascal calculation progress and the results

```
program luxun;
var j,k:longint;
      WA,WB,SUMWA,SUMWB,x,y,n,m,w,e:extended;
      p1,p2,p3,p4,p:extended;
function pailie(a,b:longint):extended;//计算排列 A（a,b）=b*(b-1)*...(b-a+1);
var i:longint;
      g:extended;
begin
    g:=1;
       for i:=b    downto b-a+1 do
          g:=g*i;
          pailie:=g;
```

```
end;

begin
      assign(output,'output.txt');//        rewrite(output);
      e:=0;//
      WA:=0;
      WB:=0;
      SUMWA:=0;
      SUMWB:=0;
       for k:=1 to 10 do
       begin
         writeln('K=',k);
            x:=pailie(k,45);//molecular
            y:=pailie(k+1,108);//denominator
            p1:=57*(x/y) ;//the value of P1
            writeln('P1=57',x:0:0,'/',y:0:0,'=',p1:0:5);

            x:=pailie(k,45);        //
            y:=pailie(k+1,108);
            p2:=4*(x/y);
            writeln('P2=4',x:0:0,'/',y:0:0,'=',p2:0:5);

            x:=pailie(k,64);        //
            y:=pailie(k+1,107);
            p3:=37*(x/y);
            writeln('P3=37',x:0:0,'/',y:0:0,'=',p3:0:5);

            x:=pailie(k,64);         //
            y:=pailie(k+1,107);
            p4:=4*(x/y);
            writeln('P4=37',x:0:0,'/',y:0:0,'=',p4:0:5);

            p:=p1+p2+p3+p4;
            writeln('p=',p:0:5);

            WA:=k*p1+(k+2)*p2; //
            WB:=k*p3+(k+2)*p4; //

            writeln('WA',k,'=',wA:0:5);
               writeln('WB',k,'=',wB:0:5);
             SUMWA:=SUMWA+WA;//calculate the    sum of W（A）
            SUMWB:=SUMWB+WB; //calculate the sum of W（B）

            writeln;    //
```

```
            writeln;

        end;
                writeln('SUMWA',k,'=',SUMWA:0:5);
                  writeln('SUMWB',k,'=',SUMWB:0:5);

            close(output);//
End.
```

Here is the output

K=1
P1=5745/11556=0.22196
P2=445/11556=0.01558
P3=3764/11342=0.20878
P4=3764/11342=0.02257
p=0.46889
WA1=0.26869
WB1=0.27649

K=2
P1=571980/1224936=0.09214
P2=41980/1224936=0.00647
P3=374032/1190910=0.12527
P4=374032/1190910=0.01354
p=0.23741
WA2=0.21013
WB2=0.30471

K=3
P1=5785140/128618280=0.03773
P2=485140/128618280=0.00265
P3=37249984/123854640=0.07468
P4=37249984/123854640=0.00807
p=0.12313
WA3=0.12643
WB3=0.26441

K=4
P1=573575880/13376301120=0.01524
P2=43575880/13376301120=0.00107
P3=3715249024/12757027920=0.04423
P4=3715249024/12757027920=0.00478
p=0.06532
WA4=0.06737

WB4=0.20560

K=5
P1=57146611080/1377759015360=0.00607
P2=4146611080/1377759015360=0.00043
P3=37914941440/1301216847840=0.02602
P4=37914941440/1301216847840=0.00281
p=0.03532
WA5=0.03331
WB5=0.14977

K=6
P1=575864443200/140531419566720=0.00238
P2=45864443200/140531419566720=0.00017
P3=3753981544960/131422901631840=0.01520
P4=3753981544960/131422901631840=0.00164
p=0.01939
WA6=0.01561
WB6=0.10433

K=7
P1=57228713284800/14193673376238720=0.00092
P2=4228713284800/14193673376238720=0.00006
P3=373130929607680/13142290163184000=0.00881
P4=373130929607680/13142290163184000=0.00095
p=0.01075
WA7=0.00701
WB7=0.07028

K=8
P1=578691104822400/141936733762387200=0.00035
P2=48691104822400/141936733762387200=0.00002
P3=37178462987637760/1301086726155216000=0.00508
P4=37178462987637760/1301086726155216000=0.00055
p=0.00600
WA8=0.00304
WB8=0.04609

K=9
P1=57321570878428800/1405173664247633300000=0.00013
P2=4321570878428800/1405173664247633300000=0.00001
P3=379993927307714560/12750649916321117000=0.00290
P4=379993927307714560/12750649916321117000=0.00031
p=0.00335

WA9=0.00127
WB9=0.02955

K=10
P1=571157655162343680/13770701909626806000000=0.00005
P2=411576551623436800/13770701909626806000000=0.00000
P3=3754966600192430080/12368130418831483000000=0.00164
P4=3754966600192430080/12368130418831483000000=0.00018
p=0.00187
WA10=0.00052
WB10=0.01858

SUMWA10=0.73338
SUMWB10=1.46980

Introduction about other cards in "Legends of the Three Kingdoms"

Basic Card

Slash

If discarding it to a target within your attack range, the target would lose one point blood.

Every turn only one Slash card can be played.

Dodge

When you are the target of Slash, you can play a Dodge to avoid the effect of Slash.

Peach

1. In your turn, you can recover 1 point blood by using it.

2. If there is a character (include yourself) dying, you can use it to save him or her.

Strategy Card

Duel

Target: a player other than you.

From the target character to you, play a Slash card, and repeats, until one who doesn't play Slash, the one get hurt 1 point by another.

Duel may bring hurt to yourself.

Sabotage

Discard a character's card except you.

Theft

Pick up a card from a character whose distance to you within 1 range.

Arrow Rain

In your round, if discarding it, everyone except you has to play a Dodge, or he would lose 1 point.

South Invasion

Target: Every character except you.

Each character need to slide a Slash Card, or gets 1 point damage from you.

Oath in Peach Garden

Each player gains 1 point blood recovery.

All Out of None/Value add

Draw two cards.

Harvest

Reveal top X cards of the card pile, where X is the number of players still in play.

Start with you, each player in turn chooses and takes one card from the reveled cards.

Drown in Happiness Delayed Strategy

The target of this card will be judged at the beginning of the affected round: Reveal the top card of the card pile, if it is a heart card, he will not be affected; or he will lose the action step.

Lightning Delayed Strategy

Put this card in your Fate Zone.

Fate- Reveal the top card of the card pile. If it is a spade card with number from 2 to 9, Lightning deals 3 damage to you; if it is not, put Lightning in the Fate Zone of the player to the next player to take turn.

Flawless Defense/Cancel All

Play this card only when an effect of a strategy card is going to affect to a player.

The effect will not affect that player.

Murder with Borrowed Weapon

Target: another character who has weapon in equipment zone.

Effort: the target A play a Slash to another character B, or you get A's

weapon in equipment zone.

Equipment Card

BaGua Rank

Armor

When you need to play a Dodge, you can judge. If the judgement is “diamond” or “heart”, and then treat you played a Dodge. If judgement is “spade” or “club”, then still can play your Dodge from your hand card.

Justice shield

Armor

Mandatory skill, the Slash with “spade” or “club” won’t make hurt on you.

This armor doesn’t work in the duel!

Rock axe

Range:3

When the target character uses Dodge to avoid your Slash, you can discard 2 more cards, to force the target hurt.

TsingGang sword

Range: 2

Mandatory skill: When you play Slash to the target character, neglect the one’s Armor ability.

The target’s armor doesn’t work in front of your Slash.

Ice Sword

Range:2

When your Slash make effort to the target, you can choose to stop the hurt, but discard 2 cards from target. (Not include the card in fate zone)

Looks like 2 “Sabotage”, but can’t be canceled.

Dragon broadsword

Range:3

If your Slash is missed by target’s “Dodge”, you can play another Slash again on the same target until the Slash take effort.

Triple halberd

Range:4

If the Slash you played is your last hand card, you can make 1-3 targets. The settlement is the action order.

Kylin bow

Range: 5

When you make hurt on the target character by Slash, you can discard one +1 or -1 horse in the one's equipment zone.

ZhuGe Crossbow
Range: 1
In play phase, you can play any amounts of Slash.

Couple swords
Range: 2
When you play a Slash and target to an opposite gender character, before the settlement of Slash, the target choose that: discard I hand card or you draw 1 card.

Snake Spear
Range: 3
You can slide any hand cards as a Slash to play.

-1 Horse: Offensive Horse.
When you calculate the distance from you to other character, it -1 (Offense advantage).

+1 Horse: Defensive Horse
When the one calculate the distance from you to the one's, it +1 (Defense advantage).

The game rules of Legends of three kingdoms

Intrudution
1. Invented by students in Communication University of China.
2. Designed with the novel of the Three Kingdoms.
3. Player number:2-10.
4. Players take a role, from warrior to sage.
5. Role playing card game like mafia.

Basic rules:
1. At the beginning of the game, every player will be assigned a special role randomly, which decides the direction to play the card right.
2. And the one who gets the role names "Lord" should open his role card to let everyone know, while the others' are hide, like the famous game "Killer".

The condition of death

Every time the general is attacked, he will lose a point of health. He will die

after run out of health and quit the game. If the player choose zhoutai, he can use the skill never surrender and display it. In this way he won't die. He can still use never surrender in the later continual attack when he run out of health. If the point is the same with the former, he will die.

For example, when he use never surrender for the first time, the point is heart 6 and he continues the game. For the second time, the point is club 2 and he can continue. If the third one is (club or spade)6 or 2, he will die. Unless someone offers him a peach at that time, he won't be able to take the card off and continue.

Legends of three kingdoms and the distinguish from the history

In the meantime, we must declear that the game is not run entirely according to the history of the three kingdoms. In the game, Liu Bei can be the lord while Guan Yu is insurgent and he will kill Liu Bei. As for the country of Wei , the most power ones are not Cao Cao, Sima Yi, which people consider it as the king, but the unknown ones, like Guo Jia, Zhen Ji. As for Wu, Shu and Qunxiong, the most powerful ones are not Lv Meng, Wuhujiang, Yuan Shao , but Huang Yueying and Diao Chan. The victory is aimed to enable the country to win, but let the insurgent kill the lord and spy stay alive to the last round and kill the lord. Due to the conflict with people's common sense, so we have to declear here.