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1 Introduction

In this paper I analyze singles party in Japan by using Game theory. Most of those parties are held by men group and women group composed of same number of persons in order to make couples. Because one-to-one matching can be allowed in making couples, it gives rise to highly strategic situations among the participants, which include tactics between the same sex and the other sex.

In the following paragraph, I show you the peculiar background of this game in Japan. After that I formalize this situation in game theoretic mode. And in the last paragraph I summarize the results and clarify the way of further studies.

2 Background

In most cases, singles parties are carried out by 4 or 5 men and women. They meet up to make couples. The main function of such parties is to make the time to talk with the members of the other group. After 2 or 3 hours, some participants can get the partner and other ones can not.

In the typical type of singles party in japan, the participants talk over a square table, with all men sitting on one side and all women sitting on the other side. Then they inevitably have more time to talk with the member sitting in front of them than the other members. The aim of this meeting is, however, finding the partner. And all people think the more choice is better. Thus "Sekigae" is done there. "Sekigae" is the Japanese term which means changing seats. By doing "Sekigae", they get the equal time to talk with all the members of the other sex group.

It is sure, however, that "Sekigae" deprives the participant of the time to make bigger the probability of getting a couple with each one candidate, because he or she could make a better impression on the future partner if he or she had the more time to talk with the person.

This trade off arises the strategic situation on the happy party. Then I analyze the condition which they should have "Sekigae" by using game theory. Furthermore I study the effect of quality gap in the same sex group. For simplification, in this paper, I consider only "2 men vs 2 women" situation, but the essence of the result will not change in more persons case.

The most important point of this paper is the definition of the success of this party. I define the success in this case by "all participants can get the partner" rather than "the expected number of members getting the partner". This is because almost all participants actually want their one-night stand rather than their companion for life through the party, and so the most essential purpose in the meeting is that all members have so good an experience that they are looking forward to the next party. According to this purpose, the success is "all participants can get the partner".

3 Analysis

3.1 No quality gap case

First I formalize both group have no quality gap in each group.

Let A and B be two men, and a and b be two women. Then each man have two choices, i.e. a or b. And each woman also have two choices, i.e. A or B. In order to summarize the payoff, I write $[\alpha, \beta]$ as indicating "a chooses α and b chooses β ", and (α, β) as indicating "A chooses α and B chooses β ". The payoff matrix can be expressed as Table1 by using this notation, where x is the payoff of getting the partner and y is the payoff of no matching.

Given the communication skills of members are same, with "Sekigae", all members have the same amount of information about the other sex members. Then, letting $P_\alpha(\beta)$ be the probability of α chooses β, $P_A(a) = P_B(a) =$

Women

Men	$[A, A]$	$[A, B]$	$[B, A]$	$[B.B]$
(a, a)	(x, y, x, y)	(x, y, x, y)	(y, x, x, y)	(y, x, x, y)
(a, b)	(x, y, x, y)	(x, x, x, x)	(y, y, y, y)	(y, x, y, x)
(b, a)	(x, y, y, x)	(y, y, y, y)	(x, x, x, x)	(y, x, x, y)
(b, b)	(x, y, y, x)	(y, x, y, x)	(x, y, y, x)	(y, x, y, x)

Table 1: no difference vs no difference

$P_a(A) = P_b(A) = \frac{1}{2}$. Now I assume that the decision of each person is independent. In this case, the probability of achieving $((a, b), [A, B])$ or $((b, a), [B, A])$ is $2\left(\frac{1}{2}\right)^4 = \frac{1}{8}$.

Next I consider without "Sekigae" case. I can set the talk pair as "A - a" and "B - b" without loss of generality and let θ be the probability gain by longer time talking, i.e. $P_A(a) = P_B(b) = P_a(A) = P_b(B) = \frac{1}{2} + \theta$, where $-\frac{1}{2} \leq \theta \leq \frac{1}{2}$. Because the decision of each person is independent, $P((a, b)) = P([A, B]) = \left(\frac{1}{2} + \theta\right)\left(\frac{1}{2} + \theta\right)$ and $P((b, a)) = P([B, A]) = \left(\frac{1}{2} - \theta\right)\left(\frac{1}{2} - \theta\right)$. This leads to that the probability of achieving $((a, b), [A, B])$ or $((b, a), [B, A])$ is $\left(\frac{1}{2} + \theta\right)^4 + \left(\frac{1}{2} - \theta\right)^4 = 2\theta^4 + 3\theta^2 + \frac{1}{8}$. By the above discussion, the probability of the success is bigger when "Sekigae" is not carried out since θ^2 and $\theta^4 \geq 0$. Furthermore this says that θ can be negative, or the talk can be used as the tool of giving their own negative impression. And note that I assume that θ is equal among all members.

3.2 One side quality gap case

I assume that the quality gap can be viewed by the other group. And the gap exists in the men group without loss of generality. Then H (high quality) and L (low quality) are the two men. By using the same notation of the previous setting, I can express the payoffs in the figure 2, where x_h is the payoff of matching with the high quality man and x_l is one of that with the low quality ($x_h > x_l$).

Women

Men	$[H, H]$	$[H, L]$	$[H, L]$	$[L.L]$
(a, a)	(x, y, x_h, y)	(x, y, x_h, y)	(y, x, x_l, y)	(y, x, x_l, y)
(a, b)	(x, y, x_h, y)	(x, x, x_h, x_l)	(y, y, y, y)	(y, x, y, x_l)
(b, a)	(x, y, y, x_h)	(y, y, y, y)	(x, x, x_l, x_h)	(y, x, x_l, y)
(b, b)	(x, y, y, x_h)	(y, x, y, x_l)	(x, y, y, x_h)	(y, x, y, x_l)

Table 2: difference vs no difference

With "Sekigae", by the same logic of the previous setting, men put the same probability on each choice, i.e. $P_H(a) = P_L(a) = \frac{1}{2}$. Then all rows in the figure 2 happen with a probability of quarter 1. In this situation the payoff matrix of the women side can be expressed as figure 3 due to the calculation of the expected value from figure 2.

b

a	H	L
H	$(\frac{x_h+y}{2}, \frac{x_h+y}{2})$	$(\frac{x_h+y}{2}, \frac{x_l+y}{2})$
L	$(\frac{x_l+y}{2}, \frac{x_h+y}{2})$	$(\frac{x_l+y}{2}, \frac{x_l+y}{2})$

Table 3: women's payoff matrix with Sekigae

Since $x_h > x_l$, H is a strict dominance strategy for both a and b. This means that $[H, H]$ is realized in figure 2. Then two matching can never be achieved in this case.

Next I consider no "Sekigae" case. Let the talk pair be "H - a" and "L - b" without loss of generality and θ be the probability gain by the longer talks ($-\frac{1}{2} \leq \theta \leq \frac{1}{2}$). Given that $P_H(a) = P_L(b) = \frac{1}{2} + \theta$, women side have the payoff matrix expressed in figure 4.

		b	
		H	L
a	H	$((x_h - y)\theta + \frac{x_h+y}{2}, (y - x_h)\theta + \frac{x_h+y}{2})$	$((x_h - y)\theta + \frac{x_h+y}{2}, (x_l - y)\theta + \frac{x_l+y}{2})$
	L	$((y - x_l)\theta + \frac{x_l+y}{2}, (y - x_h)\theta + \frac{x_h+y}{2})$	$((y - x_l)\theta + \frac{x_l+y}{2}, (x_l - y)\theta + \frac{x_l+y}{2})$

Table 4: women's payoff matrix without Sekigae

For example, I calculate the payoffs of the case in which both a and b chooses H.

$$\text{a's payoff} = (\frac{1}{2}+\theta)(\frac{1}{2}-\theta)x_h + (\frac{1}{2}+\theta)(\frac{1}{2}+\theta)x_h + (\frac{1}{2}-\theta)(\frac{1}{2}-\theta)y + (\frac{1}{2}-\theta)(\frac{1}{2}+\theta)y = (x_h - y)\theta + \frac{h_h + y}{2}$$

$$\text{b's payoff} = (\frac{1}{2}+\theta)(\frac{1}{2}-\theta)y + (\frac{1}{2}+\theta)(\frac{1}{2}+\theta)y + (\frac{1}{2}-\theta)(\frac{1}{2}-\theta)x_h + (\frac{1}{2}-\theta)(\frac{1}{2}+\theta)x_h = (y - x_h)\theta + \frac{h_h + y}{2}$$

the rest of all components in figure 4 can be calculated by this logic.

For simplicity let $\theta > 0$. And I assume that $x_h > x_l > y$. This is the key assumption. Now H strictly dominates L for a by the assumption. Thus if b's payoff of choosing L is bigger than one of H, $[H, L]$ can be achieved. The condition is as follows.

$$k$$

		Women			
		$[H,H]$	$[H,L]$	$[H,L]$	$[L.L]$
Men	(h,h)	(x_h, y, x_h, y)	(x_h, y, x_h, y)	(y, x_h, x_l, y)	(y, x_h, x_l, y)
	(h,l)	(x_h, y, x_h, y)	(x_h, x_l, x_h, x_l)	(y, y, y, y)	(y, x_l, y, x_l)
	(l,h)	(x_l, y, y, x_h)	(y, y, y, y)	(x_l, x_h, x_l, x_h)	(y, x_h, x_l, y)
	(l,l)	(x_l, y, y, x_h)	(y, x_l, y, x_l)	(x_l, y, y, x_h)	(y, x_l, y, x_l)

Table 5: difference vs difference

4 Conclusion