# The relation between a short-term evaluation and a long-term evaluation on office seat comfort

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Abstract: In this study, we assumed two types of evaluation: short-term and long-term. For example, if we administer a questionnaire on seat comfort immediately after a participant has been sitting on the chair, it is a short-term evaluation, while if it has been administered some time after, it is long-term evaluation. It is thought that there are significant differences between these two types evaluation. The aim of this study was to clarify the differences between the short- term evaluation and long-term evaluation by questionnaire. We defined short-term as within 10-20 minutes and long-term as within five days. The questionnaires, which included 35 questions, were administered to 23 participants, all of whom were office workers. The number of office chairs used in the experiment was six. Results showed that the short-term evaluations tended to be more positive than the long-term evaluation on about a half of the questions. It was also found that participants tended to give a higher evaluation on questions related to the back.

Key words: seat comfort, evaluation, office chair, subjective evaluation, short-term evaluation, long-term evaluation

#### 1. Introduction

In this paper, we assumed two types of evaluation on seat comfort research: short-term and long-term. For example, if we administer a questionnaire on seat comfort immediately after a participant has been sitting on the chair (within about five-ten minutes), it is a short-term evaluation, while if we administer a questionnaire on seat comfort after a participant has been sitting on the chair for about five days, it is a long-term evaluation.

Usually a short-term evaluation was employed on seat comfort research. It is assumed that there are significant differences between these two types evaluation. Naturally, user has some postures when he was sitting on a chair. It is thought that he will evaluate seat comfort of the chair after adding up the points scored in individual items with seat comfort. It is thought that it is necessary to employ a long-term evaluation. But a long-term evaluation has some demerits. For example, it takes time and subjects may have big load more than a short-term evaluation. So, researcher on seat comfort almost employs a short-term evaluation.

In the case to employ a short-term evaluation, it is needed that we have same result when we employ a longterm evaluation. But we don't know the past articles to research the relation between a short-term evaluation and a long-term evaluation. I compare the result employed by a short-term evaluation with the result employed by a long-term evaluation.

This paper aims to clarify the difference of the result on seat comfort employed with each evaluation method.

# 2. Research Method

### 2.1 Questionnaire

I establish questionnaire (35 questions, Table-1) to evaluate seat comfort. These questions are decided based on the questions which were gotten by the past study [2]. Also the questions which are used usually when we evaluate chair/seat are included.

Subjects have seated on an office chair for five days from Monday to Friday. And they evaluate seat comfort (five scale method for the questionnaire) at Friday evening.

Subjects seated six office chairs for this research every other week (Fig-1). So it takes 12 weeks a subject to finish. The chair order which subject sits is set at random. Subject sits on usual office chair next week after they sat on research chair.

Table-1 Questions (excerpts)

<ol> <li>When you have changed your posture, What do you feel the degree of following up with the seat pan and the back? (very strong(+2),strong(+1),neither(0),weak(-1),very weak(-2))</li> </ol>
<ul> <li>2. When do you pose in a reclining position on the chair, What do you feel the degree of slipping on the seat? (very easy of slipping(+2),easy of slipping(+1),neither(0), uneasy of slipping(-1),very uneasy of slipping(-2))</li> </ul>
<ul> <li>3. When you have changed your posture,</li> <li>What do you feel the degree of support on the part of your thigh? (very strong(+2),strong(+1),neither(0),weak(-1),very weak(-2))</li> </ul>
3.1 What do you feel 'good-bad'? (very good(+2),good(+1),neither(0),bad(-1),very bad(-2))
<ul> <li>4. When do you change your posture to a reclining position,</li> <li>What do you feel the degree that your shirt slips off your body?</li> <li>(very easy of slipping(+2),easy of slipping(+1),neither(0),</li> <li>uneasy of slipping(-1),very uneasy of slipping(-2))</li> </ul>
5. Can you change your posture easily? (very easy(+2),easy(+1),neither(0),difficult(-1),very difficult (-2))
8. What do you feel the degree of fitting to the seat pan? (very easy of fitting(+2),easy of fitting(+1),neither(0), uneasy of fitting(-1),very uneasy of fitting(-2))
23. What do you feel synthetic seat comfort? ('good-bad') (very good(+2),good(+1),neither(0),bad(-1),very bad(-2))

Group A	Â	₹	R	¥ V	₽ ₽	
<b>751</b> Ci (1 1C	Subject H	No.4	usual	No.2	usual	
of subjects (Six persons)	Ž	Ŕ	R	47	QX	
	Subject E	No.2	usual	No.5	usual	
		First week	second week	third week	fourth week	twelfth week
Group B	Ž	Ŕ	Ŕ	¥	¥	
The latter half	Subject D	usual	No.4	usual	No.2	
of subjects (Six persons)	Å	↓ ₹	↓ ↓	↓ ↓	4	
	Subject A	usual	No.2	usual	No.5	

Figure-1 research schedule and allotment of chairs

# 2.2 Object

Six office chairs in an office furniture maker are selected (Table-2, Figure-2) for this research. These chairs have different function for reclining subject posture.

If six chairs are selected from several furniture makers, it is thought that these chairs will have uneven quality.

Chair	First sales year	Reclining mechanism	Fix of back	Cost(yen)
No.1	1961	rocking	Not	5,000
No.2	1978	back shake(角度調整は可)	Yes	15,900
No.3	1980	reclining with seat pan	Yes	49,000
No.4	1987	reclining with seat pan(Knee-tilt reclining)	Not	69,800
No.5	2000	reclining with seat pan(Ankle-tilt reclining)	Yes	65,000
No.6	2002	reclining with seat pan(Ankle-tilt reclining)	Yes	39,800

Table-2 The performance and cost of chairs



Figure-2 Office chairs for experiments

# 2.3 Subject and research term

Subjects are 23 office workers (12 males, 11 females) in A college. They are subjects with the age between 22 and 58(Table-3). They sat on research chairs over three days a week in office time. And they sat on over five hours a day. The research was conducted in two terms as follows. Subjects were employed on each research.

1) From eighth at November 2004 to tenth at February 2005

(not included from twenty fifth at December 2004 to tenth at February 2005)

2) From ninth at May 2005 to twelve ninth at July 2005

	sex	age		sex	age		
	Male	30		Male	31		
	Male	31		Male	36		
	Male	40		Male	54		
	Male	41		Male	55		
Group A	Male	47	Group B	Female	22		
F	Male	48		Female	23		
(2004/11/8	Male	55	(2005/5/9	Female	31		
~2005/2/10)	Male	56	~2005/7/29)	Female	35		
	Female	25		Female	47		
	Female	37		Female	57		
	Female	38		Female	58		
	Female	45					
average age(male) :43.7age average high (male):166.5cm average weight(male):68.0kg							
average age(fema	ile):38.0age	average high (f	emale):255.0cm av	erage weight(fe	emale):52.3kg		

**Table-3 Subjects** 

### 2.4 Analysis Method

The difference on the average of every question between a short-term evaluation and a long-term evaluation are considered in this paper. Following numerical expression is calculated in every question.

1) (the average of a question on a long-term evaluation) minus (the average of a question on a short-term evaluation)

2) (the standard deviation of a question on a long-term evaluation) minus (the standard deviation of a question on a short-term evaluation)

We call the result of 1) "A-data" and call the result of 2) "S-data" in this paper.

#### 2.4.1 Analysis of average

If A-data is over "0" (zero) or equal to "0" (zero), it means that we may use a short-term evaluation for seat comfort. But if there is big difference, we must think that a short-term evaluation is not equal to a long-term evaluation.

While, if A-data is much less than "0" (zero), it means that a short-term evaluation is high score more than a long-term evaluation. In this case, we must be attentive to evaluate seat comfort with a short-term evaluation.

#### 2.4.2 Analysis of standard deviation

If S-data is under "0" (zero) or equal to "0" (zero), it means that the scattering of a short-term evaluation is less than a long-term evaluation. We may be able to evaluate seat comfort by a short-term evaluation.

While, if S-data is much more than "0" (zero), it is thought that a short-term evaluation is not equal to a long-term evaluation. In this case, we must be attentive to evaluate seat comfort with a short-term evaluation.

Fig-3 is made based on these two data. The X-axis is made with A-data. The Y-axis is made with S-data. When a point with A-data and S-data of a question is plotted on Fig-3, we can analyze the character of the question. For example, if a short-term evaluation is almost equal to a long-term evaluation, a point of every question is plotted nearby the original.



But we don't have a concrete criterion to judge in past papers. So, next criterion in this paper is assumed.

1) Average : If A-data on 33 and 20 percentage of subjects (a third of subjects = 8 persons and a fifth of subjects = 5 persons) is under "0" (zero), it is assumed that a long-term evaluation is not equal to a short-term evaluation and fall down.

2) Standard deviation: If the 33 and 20 percentage of the subjects (8 persons and 5 persons) is over "0" (zero), it is assumed that the evaluations of the subjects vary widely.

And it is thought that a long-term evaluation is not equal to a short-term evaluation.

### 3. Result

#### 3.1 The evaluation on the synthetic question of seat comfort

It is shown a tendency that the average score is higher from chair No1 to chair No6 little by little (Fig-4) [3]. From a viewpoint of the average score, seat comfort of chair No5 is highest in six chairs. The evaluation for chair No1 is only minus. It means that seat comfort of chair No1 is not comfortable. The evaluation for chair No2 is neither comfort nor discomfort. The average score of chair No5 is highest in six chairs on synthetic question.

Fig-5 is made by the view on Fig-3 for Question 1 and 2. There are cases for bad and good on each question.



Figure-4 the result of synthetic seat comfort

(the difference between a short-term evaluation and a long-term evaluation)



Figure-5 The difference between a short-term evaluation and a long-term evaluation on Question 1 and 2

#### 3.2 Result to compare between a short-term evaluation and a long-term evaluation

A-data and S-data of every question are calculated in Table-4. There are nine questions which a short-term evaluation is less than a long-term evaluation. These questions are shown on the dark gray zones in Table-4.

These are out of this criterion more than four chairs. These are Question No2 (the degree of seat slipping), No3-2 (the quality of the degree of seat hardness at thigh), No12(the quality of the hand of seat material), No13-2(the quality of seat width), No15(the degree of back width), No16(the quality of the adjustment of seat height), No19(the degree of an impact when sit on seat), No20(the degree of a sense of stability) and No25(the total evaluation of seat comfort).

There are seven questions which a short-term evaluation is less than a long-term evaluation on three chairs. These questions are shown on the light gray zones in Table-4.

			No.1			No.2			No.3			No.4			No.5			No.6		Average fal	l down rate
		A verage(a	The	The	A verage(a	The	The	Average(a	The	The	A verage(a	The	The	A verage(a	The	The	A verage(a	The	The	Average	Average
Question	uestion N	long-term)	difference	difference	long-term)	difference	difference	long-term)	difference	difference	long-term)	difference	difference	long-term)	difference	difference	long-term)	difference	difference	difference	difference
the degree of following up		-	of A-data	of S-data	-	of A-data	of S-data	-	of A-data	of S-data	-	of A-data	of S-data	-	of A-data	of S-data	-	of A-data	of S-data	of A-data	of S-data
with the seat pan and the	1	0.46		С	-0.33			0.50			0.75	С	В	1.35			0.82	D	С	-17.7	2.34
the degree of slipping on the									1												
seat	2	0.00	С	В	0.25	C	A	0.79	+	B	0.67		<u> </u>	0.61	D	D	0.50	D	С	-49.2	-5.02
the degree of support on the part of your thich	3	-0.17		D	0.08	C		0.00		А	-0.17			-0.09			-0.14		в	-69.6	-6.97
feel 'rood-had'	3(2)	-0.42	C		0.08		C	0.38	+		0.33	C	C	0.65	C	в	0.68		C	-19.1	5.23
the degree that your shirt		0.12			0.00			0.50		+	0.55			0.05			0.00				
slips off your body	4	-0.42	С	L	0.13	L		0.25	В	D	0.38		L	0.39	L		0.55	В		18.8	4.92
change your posture easily	5	-0.17			0.21	L		0.83			0.75		L	1.26			1.18		D	-7.0	4.69
smooth of reclining	6	-0.88			-0.83		С	-0.38			0.13			0.00	D	В	0.09			-20.8	-6.48
feel 'good-bad'	62	-0.33	С	С	-0.42		L	0.38	1	С	0.58	L		0.78			0.73			-6.5	3.82
easy of reclining adjustment	7	$\leq$	$\sim$	$\leq$	$\sim$	$\sim$	$\sim$	0.79	D	D	-0.67		L	0.74	С		1.14		В	$\sim$	$\sim$
the degree of fitting to the	0	1.17		D	0.12	C		0.46			0.25			1.00			0.01			6.4	0.26
feat transformed band?		1.00		<sup>D</sup>	-0.13	<u> </u>		0.40			0.25		C	1.00			0.91			12.4	-0.20
the degree of fitting to the	<u> </u>	-1.00			-0.15	- <u> </u>		0.40			0.21			1.15	+		0.80			-15.4	0.28
back	9	-0.54	D		-0.50	С		0.17	В		0.63			1.04		Α	0.27	D	С	-28.7	-4.22
feel 'good-bad'	92	-0.54	D	Г — — —	-0.57	D		0.25		T	0.71		F	1.13	Γ	В	0.27	D	D	-40.3	0.58
the degree of fitting to the					0.46		Γ		Ι			F		0.00		Γ	0.45				
lower back	10	-1.1/		<u> в</u> –	-0.46		- <u>-</u> -	-0.08	+		0.54			0.83		<u>A</u>	0.45			-28.9	-5.84
feel 'good-bad'	10(2)	-0.92	<u> </u>		-0.54	<u> </u>		0.21	+>		0.46		- <u>B</u>	1.00		+	0.55	<u> </u>		-32.7	-5.68
upper back	11													0.78		А	0.36	С			
feel 'good-bad'	112													0.96		В	0.27	D		$\sim$	
the degree of touching	12	-1.00	r	С	0.42	С	r	0.75	r	D	0.83	r	r	0.91	С		1.09			-14.3	8.43
the degree of seat width	13	-1.21			-0.50	С		-0.29			0.58		С	1.09	В		0.77	В	С	4.4	6.65
feel 'good-bad'	13②	-1.08			-0.13	D	В	0.33	T	D	0.58	F	D	1.04		С	1.00	С	Γ	-16.7	8.73
the degree of seat depth	14	-0.88			-0.25		r	-0.21	С		0.00	F		1.22	Α	T	0.91	В		11.7	-4.45
feel 'good-bad'	142	-0.61			0.13			0.29		C	0.17	C	В	0.96	Г	D	0.81			-8.4	3.17
the degree of back width	15	-1.08	С	[	-0.58	С		-0.42	С		0.67		В	1.22	[		0.95		С	-9.1	0.22
feel 'good-bad'	15②	-0.79	D	Α	0.00			0.00	С	С	0.75			1.26		IIII	0.91			-19.3	-0.47
easy of seat high adjustment	16	-1.17	В	L	0.25	D		1.08	L	[	0.29	D	L	0.96	С	С	1.27	С	С	-25.1	4.59
the degree of fitting to back	17				0.17	C		0.20	D												
curve	1/	1.21	<u> </u>	<	0.17			0.29			0.20	<u> </u>	<	0.06		< <u> </u>	1.00	<u> </u>	<u> </u>		4 07
faal 'mod bad'	182	1.21			0.04	D		0.50			0.29			0.90		- <u>-</u>	0.05			22.1	2 65
the degree of sitting impact	10.2	-1.21			-0.15			_0.58	+		0.29			0.91			0.95		<sup>0</sup>		-2.05
on the seat pan	19	-0.79		В	-0.17	С	В	0.42	L	С	0.04	D		0.43	С	В	0.64	В		-41.6	-3.25
stable of the chair	20	-0.46		A	0.08	D	D	1.00	Ι	D	1.00		D	1.39		D	1.32	I	D	-16.9	20.74
easy of adjustment lever	21	-1.08	В		-0.75		r	0.88	С	D	-0.21	F		0.57		T	1.14	1	С	-2.1	9.30
the place of adjustment lever	22	-1.13			-0.50		D	0.79			-0.08			0.87			1.23		С	1.8	6.46
synthetic seat comfort	23	-0.92		Г — — — —	-0.08	Γ	С	0.54		С	0.58		С	1.30	Γ	D	1.00	С	D	-10.8	16.72
The number of the question	ons which	26			10			-						1							
evaluation is under '0(bad The number of the question	ons which	20	<	K	19	K	K		K	K	4	K	K	<sup>1</sup>	<b></b>	<b>/</b>		K	<		
evaluation fall down			9	6		18	10		7	11		8	6		7	6		10	14		
The number of the question	ons which		2						2						3			4			
C valuation fise			-		1		1			1			1	1	5	1	1	1 7			

Table-4 All subjective evaluation for seat comfort

Note 1 : About the alphabet of A-data in the Table

A : the case which subjects of 33 percent evaluate over 1 scale

B : the case which subjects of 20 percent evaluate over 1 scale

- C : the case which subjects of 20 percent evaluate under 1 scale
- D : the case which subjects of 33 percent evaluate under 1 scale

Note 2 : About the alphabet of S-data in the Table

A : the case which deviation data decrease as subjects of 33 percent evaluate on same scale

B : the case which deviation data decrease as subjects of 20 percent evaluate on same scale

C : the case which deviation data increase as subjects of 20 percent evaluate on different scale

D : the case which deviation data increase as subjects of 33 percent evaluate on different scale

These are Question No1 (the performance of back following), No9 (the degree of fit feeling at back), No9-2 (the quality of fit feeling at back), No10-2 (the quality of fit feeling at lumber), No13 (the degree of seat width), No14-2 (the quality of seat depth), No18 (the performance of chair movement).

We have a tendency that evaluation falls down on 16 questions which are about a half of all questions. It is thought that a short-term evaluation is little higher than a long-term evaluation.

If we can know usual fall rate on every question, we may guess a long-term evaluation with a short-term evaluation. Average fall rate of every question in this experiment are shown in right column of Table-4.

Average fall rate is in the range of about 5-40 percentages. It is thought that Usual fall rate on every question is different. While, the range of standard deviation is narrow.

So, these questions are classified at next three groups.

1. the group of questions about seat

2. the group of questions about back

3. the group of questions about posture change

Average fall rate in each group is calculated. Average fall rate in the group of questions about seat and posture change is about 15 percentages. Average fall rate in the group of questions about back is about 30 percentages. It is assumed that usual fall rate of average in the group of questions about back is more than other.

And there are about 7-10 questions which the average fall down except chair No2.

While, there are 19 questions on chair No2. As the reason for this result, it is thought that chair no2 have different movement on reclining mechanism.

By the way, it is assumed that this subject evaluation may be under the influence of subject low consciousness on the research with subjective evaluation method. But many subjects wrote some free comments on this questionnaire. It is thought that the subjects had high consciousness for seat comfort. So, it is supposed that this subject evaluation may not be under the influence of subject low consciousness.

#### 4. Conclusions

The experiment which subject evaluates on seat comfort of office chair at a short-term and a long-term by questionnaire was examined in this paper. This paper clarifies that there is a difference of subjective evaluation between a short-term evaluation and a long-term evaluation. It is thought that subjects evaluate more comfortable at a short-term compared with a long-term.

We don't evaluate seat comfort with only subjective evaluation method. But we mainly research seat comfort with this method at a short-term. So, we must be attentive to evaluate seat comfort by a short-term evaluation.

# 5. References

[1] When we are going to evaluate seat comfort of a chair, we have some methods. For example, there are the distribution map of seat pressure and an electromyogram (EMG) and questionnaire. In this study, we are going to discuss seat comfort of office chair based on by the result of questionnaire.

[2] Hideki Sakamoto and Mitsuaki Shiraishi, (2004) *The transition of function of office chair at past world war 2: Summaries of Technical papers of Annual meeting*, 2004.8., *Architectural Institute of JAPAN*, JAPAN.

[3] Naturally, the fixed price of every chair is different. New chair is demanded good seat comfort. And new mechanism is adopted at new chair. So, it is thought that seat comfort rise good in order of the age of sale.

# 6. Appendix

The followings are the questionnaire (pp.1 - pp.5) written by original language (Japanese).

10 直後 「液鉄車10. イス10. □ 1週間後 期間	6. リクライニングの硬さはどうですか	
以下の質問について適当なところにOをつけてください( * は数字を記入してください)	→ それは自分にとってどうですか	硬い やや硬い どちらでそや来らかか柔らかい ない い
氏名 性別 男 女 年齢* 才		良い やや良い どちらでもやや悪い 悪い ない
ダ次 (cm) 140 140- 145- 150- 155- 160- 165- 170- 175- 180- 185- 190- 195- 200 以下 145 150 155 160 165 170 175 180 185 190 195 200 以上 体重	7. リクライニング機構の調整のしやすされどうですか ※イス№1,2,4,6の場合のみお答えください	調整しや やや調整しどちらで そや調整し調整しに すい やすい ない にくい くい
(kg) 40 40-45 50 55 60 65 70 75 80 85 90 55 10 21 21 22 22 22 22 22 22 22 22 22 22 22	<b>8</b> . 座面のフィット感はどうですか	フィット ややフィッどちらですややフィ フィット
<ul> <li>         ・ (約.5時間単位でお答えください)         ・ (0.5時間単位でお答えください)         ・ 1時間あたりの立ち差りの回数はほぼどれくらいですか。         ・ 1時間あたり 約         回         </li> </ul>	→ それは自分にとってどうですか	感が高い ト感が高いない ト感が低! 感が低い 良い やや良い どちらですやや悪い 悪い ない
今回産ったイスについて、深く産った状態でO印をつけてください <u>※ 1~6の寛間にはリクライニングしながらお答えください</u>	<ol> <li>背もたれのフィット感はどうですか</li> </ol>	·
1. 姿勢を変化させたとき、度面・背もたれの追随性はどうですか ※イス版1,3,50場合は背もたれのみの追随性をお客えください 追随する やや追随しどらですや空間し追随しな ない ない い	→ それは自分にとってどうですか	フィット ややフィンどちらでもややフィ フィット 感が高い ト感が低い 感が低い し、 やや良い どちらできやを悪い 悪い
*2. 育を後ろに傾けたとき、尻の位置のずれ(すべり)はどうですか すれる やや どららでややずれずれない すれる ない い	10. 腰部のフィット感はどうですか	
<ol> <li>姿勢を変化させたとき、大腿部へのあたりの強さはどうですか</li> <li>第1、 やや強いどちらでやや弱い 弱い ない</li> </ol>	→ それは自分にとってどうですか	フィット ややフィンどちしてそやヤフィ フィット 感が高い ト感が低い感が低い 良い やや良い どちらでそやや悪い 悪い
→ それは自分にとってどうですか 良い やや良い どちらでもやや悪い 悪い ない	<ol> <li>背の上部(肩甲骨あたり)のフィット感はどうですか ※イス№4,6の場合のみお答えください</li> </ol>	ない
<ol> <li>育を後ろへ傾けたとき、シャツのめくり上がりやすさはどうですか めくり上ややめくりどららでもややめくりめくり上 がりやす上がりやすない</li> <li>上がりにくがりにく いい</li> </ol>	→ それは自分にとってどうですか	感が高い ト感が高いない ト感が低! 感が低! い したい やや良い どちらでそやや悪い 悪い たい
5. 姿勢の変化は楽にできたましたか てきた やや どららでもややできりできない できた ない い	「12. 表面のさわり心地はどうですか	ト・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・
13. 座面の幅はどうですか		
広い、やや広い、どちらですやや狭い 狭い ない → それは自分にとってどうですか 日、 やや良い どちらですやや寒い 寒い		
ない 【14. 度面の奥行きの深さはどうですか 【14. 皮面の奥行きの深さはどうですか		
→ それは自分にとってどうですか 良い ややりいどちつであいない。 よい、・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・		
「15. 背もたれの幅はどうですか 広い やや広いどちらでもやや狭い 爽い		
→ それは自分にとってどうですか 良い やや良い どらびやや悪い 悪い ない		
16. 座面の高さの調整しやすさはどうですか 調整しや やや調整しどちらで{やや調整し買整し調整し すい、やすい ない にくい くい		
17. 背もたれの高さを調整することによって、背中と背もたれの形状はどうですか		
<ol> <li>         「18. 座りながらの移動はどうですか         <ul> <li></li></ul></li></ol>		
→ それは自分にとってどうですか 良い、そや良い、どらびですの ない		
19. 座った瞬間の衝撃はどうですか 通知法の一や衝撃法とらですやや衝撃法が衝撃法な るのる ない ない い		
20. イスの脚の安定感はどうですか 安定してや安定しどららでやや 安定してい いる ている ない 安定していない ない		

