Effectiveness of Behavioral Economics
－ Through Proof Experiments of Kahneman's Theory －

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Table of contents

Abstract

Daniel Kahneman established a new discipline called behavioral economics and was awarded the Nobel Prize in economics in 2002. It was "Prospect theory" and "Heuristics" that he proposed with Amos Tversky, a coworker, and they attempted a proof using the "only one question method", a psychological experimental technique.

This report analyzes the results of the confirmatory study that I carried out for students of the Osaka Sangyo University business administration department on May 27, 2014 (158 subjects), June 3 (121 subjects), and September 30 (168 subjects), using the same experimental technique as Kahneman and others. There were 26 questions, 11genres, and a total of 447 students.

Regarding this confirmatory study of Prospect theory, which applies also to the field of Finance, the results conformed to the theory for the most part, but they were not as remarkable as those of Kahneman's experiment, probably because students' senses of values regarding money were not uniform. On the other hand, regarding Heuristics theory, which

applies also to the field of marketing, as for me, there was concern that a difference in economic knowledge, such as Bayesian estimate and statistical cause and effect rates, might appear, but those were ground less fears. At the point of intuition, results showed that differences in knowledge and academic ability were irrelevant.

Furthermore, regarding the issue of concern over influence from difference in ethnic culture I compared Chinese foreign students with Japanese students, and the results were as follows: regarding the basic problems. both Japanese and Chinese students showed roughly the same tendency as European and American students, but regarding the correction problems, improvement in correct answer rate for the Chinese foreign students was more remarkable than the rise in correct answer rate of European and American students.

Key words：Kahneman, Prospect, Heuristics, behavioral-economics

Introduction

Daniel Kahneman let economics dock with cognitive psychology and established new discipline called the behavioral economics [1] and was awarded the Nobel Prize in economics in 2002. The Prospect theory and Heuristics that he proposed with late Amos Tversky, a coworker, overturn the expected utility theory that is a conventional basic economic theory.

However, because the inspection method is a psychological experimental technique, and it is not a thing in conformity with statistical technique even if it makes how to get the specimens, it cannot necessarily say that it was demonstrated.

Therefore, in this report, I performed confirmatory studies using "only one question method" of the psychology that was the experimental technique of Kahneman's theory.

In addition, about the confirmatory studies, I carried it out on May 27, 2014（158 subjects）, June 3（121 subjects）, and September 30（168 subjects）for students of the Osaka Sangyo University（OSU）.

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[1] The concept called "Bounded Rationality" which is a theory, therefore, to be made of the behavioral economics was proposed by Herbert A. Simon, who was awarded the Nobel Prize in Economics in 1978.

1. Prospect

（1）Theoretical summary

1）Judgement by reference point

The people judge it whether a result to be realized exceeds the reference point that each person has not the final result.

The reference point here is a standard to use when an individual performs recognition and the evaluation of things and is subjective to the last.

Therefore, the reference point will fluctuate how an individual thinks.

2）Reflection effect

When profit appears, the person becomes for risk aversion, but a loss appears; a risk of loving it, it is said that is in other words take the risk, and to wait for the improvement of the situation.

3）Non-symmetricalness of the gain and loss

The person is the same amount of money, but it is said that sorrow when I suffered a loss is bigger 2-4 times than joy when I raised profit.

（2）Confirmatory study

This experiment is the technique, called psychology of single questions, that Walter Mischel used. I performed a confirmatory study by this technique as a subject with 153 students on May 27, 2014, in Osaka Sangyo University.

1-1. Risk policy

（Question1）Choose between

　A：Sure gain of 24,000yen

　B：25% chance to gain 100,000yen and 75% chance to gain nothing [2]

（Table 1）Answer result of question1

Answer	A	B	Total
Kahneman's Experiment [3]	84.0%	16.0%	150 (100%)
Osaka Sangyo Univ.	68.0%	32.0%	153 (100%)

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[2] Kahneman Daniel,"Thinking, Fast and Slow", Penguin Books, 2012. p. 334

[3] *Ibid*. p. 437

They should choose B theoretically because B（100,000yen×25%=25,000yen）is higher than A（24,000yen）. But there was really more high A of the solidity more than double. When the person had profit in front, it followed that I demonstrated that I gave priority to the evasion of the risk that profit was not available.

In addition, by the experiment of Kahneman, it is 84A：16B, and it is the same tendency.

（Question2）Choose between

C：Sure loss of 75,000yen

D：75% chance to lose 100,000yen and 25% chance to lose nothing[4]

（Table 2）Answer result of question2

Answer	C	D	Total
Kahneman's Experiment[5]	13.0%	87.0%	150 (100%)
Osaka Sangyo Univ.	24.2%	75.8%	153 (100%)

C（-75,000yen）was the same as D（-100,000yen×75%=-75,000yen）theoretically, but there were much more people who chose D. Person choose the probability not to lose to be going to evade loss itself when the person does a loss in front.

In addition, by the experiment of Kahneman, it is 13A：87B, and it is the same tendency.

（Question3）Choose between

AD：25% chance to win 24,000yen and 75% chance to lose 76,000

BC：25% chance to win 25,000yen and 75% chance to lose 75,000[6]

（Table 3）Answer result of question3

Answer	AD	BC	Total
Number of Answers (ratio)	32 (20.9%)	121 (79.1%)	153 (100%)

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[4]　*Ibid*. p. 334

[5]　*Ibid*. p. 437

[6]　*Ibid*. p. 335

In this case they come to should choose BC（25,000yen×25%-(-75,000yen×75%)=-50,000yen）which is higher than AD（24,000yen×25%-(-76,000yen×75%)=-51,000yen）theoretically. Actually, there was predominantly much BC, but, in fact, the dominant option in BC is the combination of the two rejected of the first pair of decision problems because BC was B of question1 + C of question2.

It followed that this supplementary examination confirmed a proof experiment of the prospect theory.

In the experiment that Kahneman and Tversky carried out, 73% of respondents chose A in question1 and D in question2 and only 3% favored the combination of Band C, however, most people are choice BC in question3.

In the experiment that I carried out at OSU, 54% of respondents chose A in question1 and D in question2 and only 8% favored the combination of B and C, however, approximately 70% of respondents are choice BC in question3, it performs a mark as a result of Kahneman and others.

（Table 4）The comparison of the result

Answer	1D & 2D（contradiction）	1B & 2C（rational）
Kahneman's experiment[7]	73%	3%
Osaka Sangyo Univ.	54%	8%

1-2. Bernoulli's error
（1）Theoretical summary

Bernoulli's theory assumes that the utility of their wealth is what makes people more or less happy. The happiness that the person experience is determined by the recent change in their wealth, relative to the different states of wealth that define their reference points.

（2）Proof experiment

Kahneman and Tversky found a way to demonstrate the central error in Bernoulli's model of choice.

It is the next problem.

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[7] *Ibid*. p. 335

(Question1)

Which do you choose?

In addition to whatever you own, you have been given 100,000yen.

　You are now asked to choose one of these options

　1) 50% chance to win 100,000yen or 2) get 50,000yen for sure.[8]

(Question2)

In addition to whatever you own, you have been given 200,000yen.

　You are now asked to choose one of these options

　1) 50% chance to lose 100,000yen or 2) loss 50,000yen for sure.[9]

(Table 5) Answer result of question at OSU

Answer	1) & 1)	1) & 2)	2) & 1)	2) & 2)	Total
Number of Answers (ratio)	27 (16.4%)	47 (28.5%)	39 (23.6%)	52 (31.5%)	165 (100%)

→ We can easily confirm that in terms of final states of wealth － all that matters for Bernoulli's theory － question1 and 2 are identical. In Bernoulli's theory, therefore, the two problems should elicit similar preferences.

On the other hand, Kahneman says as follows.

In the first choice, a large majority of respondents preferred the sure thing. In the second choice, a large majority preferred the gamble.

By the supplementary examination that I carried out in Osaka Sangyo Industrial University on September 30, 2014, the answer in line with a Bernoulli's theory（1) & 1) or 2) & 2)）was approximately 48%, and the answer of Kahneman expected（2) & 1)）was only approximately 24%.

Thus, I was not able to demonstrate it with the theory of both either.

1-3. Mental accounts

(1) Theoretical summary

We hold our money in different accounts, which are sometimes physical, sometimes

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8　*Ibid*. p. 280

9　*Ibid*. p. 280

only mental.[10] We have spending money general savings, earmarked savings for our children's education or for medical emergencies.

(2) Confirmatory study

The following problem of mental accounting relates to sunk-cost.

（Question1）

You bought a ¥16 ticket to the theater, when you arrive at the theater, you open your wallet and discover that this ticket are missing.

Will you buy more ticket to see the play? [11]

（Question2）

You go to the theater, intending to buy ticket that cost ¥16. You arrive at the theater, open your wallet, and discover to your dismay that the ¥16 with which you were going to make the purchase is missing. Will you buy the ticket? [12]

（Table 6）Result of question1

Answer	1）YES	2）NO	Total
Kahneman's Experiment[13]	46.0%	54.0%	200 (100%)
Osaka Sangyo Univ.	73.9%	26.1%	153 (100%)

（Table 7）Result of question2

Answer	1）YES	2）NO	Total
Kahneman's Experiment[14]	88.0%	12.0%	183 (100%)
Osaka Sangyo Univ.	52.3%	47.7%	153 (100%)

By the experiment of Kahneman, because "YES（buy）" of problem is bigger than "YES（buy）" of problem, sunk-cost fallacy is proved. However, for students of Osaka Sangyo University, by the experiment that I carried out on May 27, 2014, it turns out opposite

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[10] The theory of Mental accounts was proposed first by Richard Thaler.

[11] Kahneman, *loc. cit.* p. 371

[12] *Ibid.* p. 371

[13] *Ibid.* p. 443

[14] *Ibid.* p. 443

and the supplementary examination ended in failure.

1-4. Framing effect

(1) Theoretical summary

Framing effect means that, even if the contents which the information means are the same, decision making is different if expression methods are different.

(2) Confirmatory study

Kahneman and Tversky made the following problem to inspect framing effect from prospect theory.

(Question1)

Imagine a certain area is preparing for the outbreak of an unusual disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimates of the consequences of the programs are as follows.

If program A is adopted, 200 people will be saved.

If program B is adopted, there is a one-third probability that 600 people will be saved and a two-thirds probability that no people will be saved.[15]

(Question2)

Then, in the next, which program do you choose?

If program A' is adopted, 400 people will die.

If program B' is adopted, there is a one-third probability that nobody will die and a two-thirds probability that 600 people will die.[16]

(Table 8)　Result of question1

Answer	1) A	2) B	Total
Kahneman's Experiment[17]	72.0%	28.0%	152 (100%)
Osaka Sangyo Univ.	56.0%	44.0%	168 (100%)

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[15] *Ibid*. p. 368

[16] *Ibid*. p. 368

[17] *Ibid*. p. 436

（Table 9）Result of question2

Answer	1）A'	2）B'	Total
Kahneman's Experiment [18]	22.0%	78.0%	155 (100%)
Osaka Sangyo Univ.	38.7%	61.3%	168 (100%)

The two versions, the consequences of programs A and A' are identical, so are the consequences of programs B and B'. In the first question, a large majority of people choose the sure（program A）, In the second frame, however, a large majority of people choose the gamble（program B'）. Kahneman says, decision makers trend to prefer the sure thing over the gamble（they are risk averse）when the outcomes are good. They trend to reject the sure thing and accept the gamble（they are risk seeking）when both outcomes are negative.

By the supplementary examination that I carried out in Osaka Sangyo University on September 30, 2014, though there is much A in Q1, there is much B' in Q2, the same tendency is seen.

2. Heuristics

（1）Theoretical summary

The definition of "Heuristics" is a simplified clue to use when I want to judge it in a short time. In other words it is a thing leading a conclusion by the reasoning and a judgment method simplified from experience, but, in the case of a solution to the problem, does not reach the necessarily correct conclusion because bias produces it by a person.

When there are few knowledge and experience about the matter to judge, information or when I am running out of time when there is too much information, as for such the Heuristics, importance in question will be used for low cases.

（2）Confirmatory study

Kahneman and others test it for students of Princeton University using a cognitive intellectual power test（CRT）that Shane Frederick made.

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[18] *Ibid*. p. 437

2-1. Heuristics by Cognitive ease

Among Heuristics, it is "Cognitive ease" to judge based on what I got used to and remembering it.

（Question1）

A bat and ball cost 1,100yen.

The bat costs 1,000yen more than the ball.

How much does the ball cost?[19]

(Table 10) Result of question1

Answer	1) 50yen	2) 100yen	Total
Number of Answers (ratio)	54 (44.6%)	67 (55.4%)	121 (100%)

By the experiment for 121 students of the Osaka Sangyo Univ. (OSU) on June 3, 2014, there were many people whom answered 100 yen from a familiar number, and the correct answer rate was 44.6%.

Kahneman said that "many thousands of university students have answered the bat-and-ball puzzle, the results are shocking. More than 50% of students at Harvard. MIT, and Prinston gave the intuitive-incorrect-answer. At less selective universities, the rate of demonstrable failure to check was in excess of 80%".[20]

That means, only for a correct answer rate of this problem, the student's level of the intuition is the same as OSU and Harvard. MIT, and Prinston.

（Question2）

If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?

1) 100minutes　2) 20minutes　3) 5minutes[21]

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[19] *Ibid*. p. 44

[20] *Ibid*. p. 45

[21] *Ibid*. p. 65

（Table 11）Answer result of question2

Answer	1)	2)	3)	Total
Number of Answers（ratio）	58（37.9%）	20（13.1%）	75（49.0%）	153（100%）

Although the degree of difficulty was at the same level as a question in front, but wrote it in choose among three limbs, and the correct answer rate rose a little; an erroneous answer rate half strong; there was it（a laboratory finding on May 27, 2014）.

（Question3）

In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?

1) 24 days　2) 36days　3) 47days [22]

（Table 12）Answer result of question3

Answer	1)	2)	3)	Total
Number of Answers（ratio）	48（31.4%）	14（9.1%）	91（59.5%）	153（100%）

The correct answer rate went up more than 10% probably because this was the problem that was easy to notice a little in comparison with a question in front,; but still an erroneous answer rate 40% strong; there was it（a laboratory finding on May 27, 2014）.

It is said that the person that all 3 were correct answers was only 10% as a result that Kahneman tested it to 40 students of Princeton University.

2-2. Halo effect
（1）Theoretical summary

The tendency to like（or dislike）everything about a person － including things you have not observed － is known as the halo effect.

（2）Proof experiment

In an enduring classic of psychology, Solomon Asch presented descriptions of two

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[22] *Ibid.* p. 65

people and asked for comments on their personality.

（Question）

Which person do you want to make friends with?

Mr. A：intelligent － industrious － impulsive － critical － stubborn － envious

Mr. B：envious － stubborn － critical － impulsive － industrious － intelligent[23]

（Table 13）Answer of result of question

	1）Mr. A	2）Mr. B	Total
Japanese student （ratio）	97 （80.2%）	24 （19.8%）	121 （100%）
Chinese foreign student （ratio）	38 （80.9%）	9 （19.1%）	47 （100%）
Total （ratio）	135 （80.4%）	33 （19.6%）	168 （100%）

Most of us viewed Mr. A much more favorably than Mr. B. By the supplementary examination that I carried out in Osaka Sangyo University on September 30, 2014, the result became more than it in Mr. A 80%, too. The initial traits in the list change the very meaning of the traits that appear later, and will be interpreted in a way that makes it coherent with the context. In addition, there were not the differences between Japanese student and Chinese foreign student.

2-3. The law of small numbers

（1）Theoretical summary

As the number of samples becomes big, it is "law of large numbers" that the average of the sample nears overall average （in the case of the dice a one-sixth）, but draws a general tendency from the result of the sample though there are few samples in a person. This called "Law of small numbers" is heuristics.

（2）Proof experiment

In the article of Kahneman & Tversky of 1972, the following problem is given.

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[23] *Ibid*. p. 82

（Question1）

60 red cue balls, 40 white ball are in the pot of A.

40 red cue balls, white 60 ball are in the pot of B.

When Mr. T chose either among pots of A or B, and it took out 3 balls from the pot, it was red 3, white 0.

And, when Mr. P chose either among pots of A or B, and it took out 10 balls from the pot, it was red 7, white 3.

The person who is high in the probability that I took out of a pot of A will be Mr. T, or will it be Mr. P?[24]

According to the experiment of Kahneman, it is said that a sample of Small one（Mr. T） was judged a pot of "much red" with high conviction.

By the supplementary examination that I carried out on May 27, 2014, I put the limb of the correct answer " 1）Mr. T　2）Mr. P　3）I can say neither".

Then sample of the small one（ 1）） which was an expected answer was fewest, and the supplementary examination completely failed

（Table 14） Result of question1

Answer	1）（T）	2）（P）	3）（Neither）	Total
Number of Answers（ratio）	38（24.8%）	56（36.7%）	59（38.5%）	153（100%）

（Question2）

Six babies were born at a hospital. Now consider three possible sequences of Boys and Girls. In addition, then outcomes Boys and Girls are equally likely.

1）BBBGGG

2）GGGGGG

3）BGBBGB

　　1）or 2）or 3）or 4）All probability is the same[25]

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[24] *Ibid.* p. 53

[25] *Ibid.* p. 115

(Table 15)　Result of question2

Answer	1)	2)	3)	4)　same	Total
Number of Answers (ratio)	28 (16.7%)	11 (6.5%)	51 (30.4%)	78 (46.4%)	168 (100%)

Only the third sequence appears random. By the supplementary examination that I carried out on May 27, 2014, the answer（3）) that Kahneman expected was 30%, but it might almost demonstrate the Kahneman's theory that the correct answer theoretically （4）) did not reach 50%, and there was the order of many answers in order of 2)＜1)＜3).

2-4. Anchoring effect

(1) Theoretical summary

When people consider a particular value for an unknown quantity before estimating that quantity, the estimates stay close to the number that people considered-hence the image of an anchor.

(2) Proof experiment

(Question1)

Did Gandhi die more than 114 years old?

YES or NO

Then estimate of his age at death.[26]

(Question2)

Did Gandhi die more than 35 years old?

YES or NO

Then estimate of his age at death.[27]

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[26] *Ibid.* p. 119

[27] *Ibid.* p. 120

（Table 16）Result of question2

	1) more than 114 years old?: NO	2) more than 35 years old?: YES	Different （1) & 2))
Average of Japanese student （Answers）	79.6 years old （60 people）	65.2 years old （53 people）	14.4 years old
Average of Chinese foreign student （Answers）	76.2 years old （21 people）	67.1 years old （24 people）	9.1 years old
Overall average （Total）	78.8 years old （81 people）	65.8 years old （77 people）	13.0 years old

Correct age is 78 years old. By the first question, the age of Gandhi gives a suggestion to be high. On the other hand, in Q2, his age gives a suggestion to be young. Therefore, Q1 should rise by the average of the age.

As a result of having tested it in Osaka Sangyo University on September 30, 2014, Q1 became the high answer 13 years old, and the anchoring effect would be in this way demonstrated.

In addition, the tendency of both does not change when I compare the answer of the Chinese foreign student with the Japanese student, but shows that a Japanese student opens 5.3 years old as for the age difference, and an anchoring effect appears in this more clearly.

2-5. Representativeness Heuristics
（1）Theoretical summary
"Representativeness Heuristics" is decision-making process to overestimate contents with a typical characteristic when I think about outbreak probability.
（2）Proof experiment
The representative problem used for this experiment reads a sentence that "Linda is thirty-one years old, single, outspoken, and very bright. she majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in artinuclear demonstrations." and among " 1) Linda is a teacher in elementary school. 2) Linda works in a bookstore and takes yoga classes. 3) Linda is active in the feminist movement. 4) Linda is a psychiatric social worker. 5) Linda is a member of the League of Women Voters. 6) Linda is a bank teller. 7) Linda is an

insurance salesperson. 8）Linda is a bank teller and is active in the feminist movement.", the possible thing evaluate [1], the impossible thing evaluate [8].

（3）Confirmatory study

1）standard problem of Linda

The supplementary examination that I performed on May 27, 2014 to 3 limbs as follows and had reply it.

（Question1）

Linda is thirty-one years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in antinuclear demonstrations.

When it expects a figure as of a thing of Linda from this portraiture, it will be which to be the highest in the probability among next.

1）Linda is a bank teller.

2）Linda is an insurance salesperson.

3）Linda is a bank teller and is active in the feminist movement.[28]

2）modified problem of Linda

Furthermore, I changed a part of Question1 as follows and made questions to a different student.

（Question2）

It will be which to be the highest in the ratio among next if there were 100 people like Linda.[29]

（Table 17）Answer result of Linda problem

Answer	1)	2)	3)	Total
Standard Problem	2 (2.6%)	21 (26.9%)	55 (70.5%)	78 (100%)
Modified problem	7 (9.3%)	21 (28.0%)	47 (62.7%)	75 (100%)

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[28] *Ibid*. pp. 156–157

[29] Eysenck W. Michael "Psychology a student's handbook", trans. by Yamauchi Mitsuya, Nakanishiya publishing, 2008. p. 525

Because more than 70% of student made a wrong reply according to the list mentioned above with, 3). "Bias by Representative" would be confirmed by the supplementary examination.

In addition, approximately 8% of erroneous answers rate falls when I make the modified problem that roused attention.

Then, I divided it into a Japanese student and a Chinese foreign student and analyzed an answer because the viewpoint for the woman might vary according to a country.

（Table 18）Answer result of Japanese student

Answer	1)	2)	3)	Total
Standard Problem	1 (1.9%)	16 (29.6%)	37 (68.5%)	54 (100%)
Modified Problem	6 (11.5%)	11 (21.2%)	35 (67.3%)	52 (100%)

（Table 19）Answer result of Chinese foreign student

Answer	1)	2)	3)	Total
Standard Problem	1 (4.2%)	5 (20.8%)	18 (75.0%)	24 (100%)
Modified Problem	1 (4.3%)	10 (43.5%)	12 (52.2%)	23 (100%)

However, by the modified problem, the erroneous answer rates of the Japanese students decrease by only 1%. On the other hand, the erroneous answer rates of the Chinese foreign students decreased by 23%.

It is said that, as a result that Kahneman tested it to an undergraduate, 89% of people ignored the probability theory. Kahneman was convinced that statistically sophisticated respondents would do better, so he administered the same questionnaire to doctoral students in the decision- science program of the Stanford Graduate School of Business, all of whom had taken several advanced courses in probability, statistics, and decision theory. He was surprised again: 85% of these respondents also ranked "feminist bank teller" as more likely than "bank teller".[30] Kahneman named this "Conjunction fallacy".

According to Fiedler, it is said that, as a result of supplementary examination, 75% of people were wrong in Q1, but, on the contrary, 75% of people answered it correctly

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[30] Kahneman, *loc. cit.* p. 158

in Q2.[31] By my experiment, the up of the correct answer rate by Q2 was remarkable towards a Chinese foreign student.

2-6. Causal base rate

(1) Theoretical summary

A base rates has two types. Statistical base rates are facts about a population to which a case belongs, but they are not relevant to the individual case. Causal base rates change your view of how the individual case came to be.

- ・Statistical base rates are generally underweighted, and sometimes neglected altogether, when specific information about the case at hand is available.
- ・Causal base rates are treated as information about the individual case and are easily combined with other case-specific information.

(2) Proof experiment (cab example)

Kahneman and others demonstrated it and tested it using "the cab example" that is a standard problem of Bayesian inference.

1) standard problem

（Question1）

A cab was involved in a hit-and-run accident at night.

Two cab companies, the Green and Blue, operate in the city.

You are given the following date.

- ・85% of the cabs in the city are Green and 15% are Blue.
- ・A witness identified the cab as Blue. The court tested the reliability of the witness under the circumstances that existed on the night of the accident and concluded that the witness correctly identified each one of the two colors 80% of the time and failed 20% of the time.

What is the probability that the cab involved in the accident was Blue rather than Green?[32]

1) more than 0% ～ less than 25%　　2) more than 25% ～ less than 50%

3) more than 50% ～ less than 75%　　4) more than 75% ～ less than 100%

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[31] Eysenck, *loc. cit.* p. 525

[32] Kahneman, *loc. cit.* p. 166

However, we are apt to answer it with a considerably high number by the intuition to become 80% when we make much of eyewitness testimony（"Causal base rates"）.

In fact it is said that there was the most was 95%, and the average was 56% again in the answer of Harvard University graduate school and the staff.

The student who chose 2) of the correct answer by the supplementary examination of May 27, 2014 when I carried it out was only approximately 18%. There was the person who chose 3) or 4) more than 60%.

（Table 20）Result of the cab standard problem

Answer	1)	2)	3)	4)	Total
Number of Answers （ratio）	16 （20.5%）	14 （17.9%）	27 （34.6%）	21 （26.9%）	78 （100%）

2) Other version problem

Then, I made questions a variation of the same story, in which only the presentation of the base rate has been altered.

（Question2）

You are given the following data:

・The two companies operate the same number of cabs, but Green cabs are involved in 85% of accidents.

・The information about the witness is as in the previous version.[33]

In this case, according to Kahneman, because "a Causal stereotypes" that the Green taxi driver is in danger is formed, the ratio of the Blue taxi falls down, and it is said that I approach the numerical value of the Bayesian inference.

By the supplementary examination of May 27, 2014, the correct answer rate surely rose slightly and, however, there was it within the error and did not prove a stereotype.

（Table 21）Result of other version cab problem

Answer	1)	2)	3)	4)	Total
Number of Answers （ratio）	14 （18.7%）	16 （21.3%）	23 （30.7%）	22 （29.3%）	75 （100%）

[33] *Ibid*. p. 167

3) Direct question

For 121 students, June 3, the same year, I asked a question about both problems directly. "The probability that is a Blue taxi?". Then, by the standard problem, correct answer rates was 6.7%, but largely improved it with 9.6% by the other version problem and, as a result, will support a theory of Kahneman Furthermore, for both problems, the answer that there was the most was 80% who were a causal base rate.

(3) Epidemic example

Similarly, the standard problem of Bayesian inference includes "the epidemic example".

・In this case a morbidity rate becomes the Statistical base rate, and a test result becomes the causal base rate

・standard problem

（Question1）

By the inspection that a morbidity rate detects a disease of one-1000th, pseudo-positive reaction（I am not sick, but become positive by the inspection）is given 5%. When the result of a certain person is given with positive, how much will the person really suffers from this disease, anticipating it be?[34]

1）more than 0% ～ less than 10%　　2）more than 10% ～ less than 50%

3）more than 50% ～ less than 90%　　4）more than 90% ～ less than 100%

→ When it is a statistical base rate, it is almost 0%, but it is 95% when it is a causal base rate, 1）was a correct answer to become 2%（1.96%）by the Bayesian inference, but, by the supplementary examination of May 27, there were the most right answers, and, as for the mistake, it was rare. However, with a direct answer type of June 3, it was 16.1%.

（Table 22）Result of the epidemic standard problem

Answer	1)	2)	3)	4)	Total
Number of Answers （ratio）	44 （58.7%）	14 （18.7%）	3 （4.0%）	14 （18.7%）	75 （100%）

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[34] Bazerman H. Max. & Moore A Don., "Judgment in Managerial Decision Making", trans by Nagase Katsuhiko, Hakutou publishing, 2011. pp. 23-24

・other version problem

（Question2）

This street people is 10,000 people. A person infected with this disease is ten people.

When 100 people who are not sick undergo inspection to detect this disease; it is five by the inspection that become the positive. When the result of a certain person is given with positive, how much will the person really suffers from this disease, anticipating it be?[35]

By the other version problem, there became surely few people dragged to a causal base rate. The correct answer rates increased a little, but it is the thing which has fallen into 8.4% as for the correct answer rate right out of June 3.

（Table 23）Result of other version problem

Answer	1)	2)	3)	4)	Total
Number of Answers（ratio）	48（61.5%）	23（29.5%）	4（5.1%）	3（3.8%）	78（100%）

2-7. Confirmation bias

（1）Theoretical summary

The person looks for information according in faith, a theory, a hypothesis having now and avoids the collection of evidence that it is a disproof. This is "Confirmation bias".

（2）Proof experiment

1）standard problem（Wason's 4 pieces of cards）

This is "Wason's 4 pieces of cards", as an experiment to demonstrate.

（Question1）

You are a part timer of the Boards of Education, and examine whether the person of the Y district enters a school of school number 3 by all means. A district is filled in the alphabet on one of the card, and a school number is filled in on one. Then, among the next cards, which card will you understand if you upset it?[36]

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[35] *Ibid*. pp. 23-24

[36] Evans St. B. T. Jonathan "Bias in Human Reasoning", trans. by Nakajima Minoru, Shinzan Publishing, 1995. p. 67

(A card)	(B card)	(C card)	(D card)
Y	Z	3	7

We have nothing to do with a solution to the problem even if "3" backs are "Y" or "other than it". However, many people choose (A) and (C), as for the information to reinforce a hypothesis ("conclusive evidence information"). to be "3" backs is "Y".

The correct answer is to turn up (D) and, however, does not want to turn up, because when "7" backs are "Y", it turns out opposite to a hypothesis ("disproof information").

About the problem mentioned above, I carried out a supplementary examination as a subject with 75 students. The result is, 58 people of them chose (C card), and the person who chose (D card) was only 10 people. Thus, "Trap of the confirmation bias" would be demonstrated.

(Table 24)　Result of 4 Wason's 4 pieces of cards (May 27, 2014 enforcement)

Answer	A & B	A & C	A & D	Total
Number of Answers (ratio)	7 (9.3%)	58 (77.3%)	10 (13.3%)	75 (100%)

2) Cholera problem

This is the problem that revised Wason's 4 pieces of cards from the side of the social psychology. It is that the correct answers will increase more than in the case 1) because we access disproof information daringly, with the thought that is not permitted socially.

(Question2)

You must examine whether a rule, "The person entering the country must get a vaccination of cholera", is observed.

It is filled in whether he admitted entry on one of the card whether he already got a vaccination on one, but, among the next cards, which card will understand if you upset it? [37]

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[37] Ichikawa Shinichi, "Cognitive Psychology" Tokyo Unive. publication society, 2009. p. 22

（A card）	（B card）	（C card）	（D card）
entry permit	Entry suppression	been vaccinated	no vaccination

→ Using this problem, I tested it to 78 different students. In comparison with the case of standard problem, the result hardly changes and will reinforce a trap of the confirmation bias.

（Table 25）Result of cholera problem（May 27, 2014 enforcement）

Answer	A & B	A & C	A & D	Total
Number of Answers（ratio）	3（3.8%）	64（82.1%）	11（14.1%）	78（100%）

3）Practice problem

The next problem is the practical problem that a law learned by experience fulfills. Is like this; when is plain, will the disproof information be ignored?

（Question3）

You work part-time at a bar. You must not offer alcohol to the visitor younger than 20 years in the shop. Therefore you let them write age on one side of the card. and drink to order on the other side, when they entered it.

4 visitors are and have the following card now. If only two people were questioned to find out a person against a rule, which card should you have reversed?[38]

（card1）	（card2）	（card3）	（card4）
21	Juice	Whiskey	16

After testing it for 121 students using this problem（June 3, 2014 enforcement）, the correct answer rate reached 76.9%. In the world, and it is said that the correct answer rate was more than 80%. Therefore, the person becomes high in the ability for concrete problem recognition depending on the situation.

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[38] Saito isamu,"Illustration An Introduction to Social Psychology", Seishinshobo, 2011. p. 96

（Table 26）Result of bar problem

Answer	3 & 4（correct）	Others（erroneous）	Total
Number of Answers （ratio）	93 （76.9%）	28 （23.1%）	121 （100%）

Conclusion

As for the confirmatory study that I carried out among this Osaka Sangyo Univ. business administration department, the respondent for one question approximately became the thing of the scale with a Kahneman's experiment, more than 150 students.

Regarding this confirmatory study of Prospect theory, which applies also to the field of finance, the results conformed to the theory for the most part, but they were not as remarkable as those of Kahneman's experiment, probably because students' senses of values regarding money were not uniform. By the Mental accounts of the Thaler proposal, a way of thinking is divided variously, and the experiment failed.

The object of the question regarding money should widen it to a member of society and the housewife in future.

（Table 27）Generalization of the proof

〈◎：completely proved　○：almost proved　×：not proved〉

Theory	Field of theory	Table	Yes or Not
1. Prospect	1-1. Risk policy	1〜4	○
	1-2. Bernoulli's error	5	×
	1-3. Mental accounts	6〜7	×
	1-4. Framing effect	8〜9	○
2. Heuristics	2-1. Heuristics by Cognitive ease	10	◎
		11	○
		12	○
	2-2. Halo effect	13	◎
	2-3. The law of small numbers	14	×
		15	◎
	2-4. Anchoring effect	16	◎
	2-5. Representativeness Heuristics	17〜19	◎
	2-6. Causal base rate	20	○
		21	○
		22〜23	○
	2-7. Confirmation bias	24〜26	◎

In addition, as for "the loss evasion effects", a lot of applicable things show the trap which amateur investors are easy to fall into in a field of the finance, but, in the world of professional investors, these elements have been already made programming.

On the other hand, regarding Heuristics theory, which applies also to the field of marketing, as for me, there was concern that a difference in economic knowledge, such as Bayesian estimate and statistical cause and effect rates, might appear, but those were ground less fears. At the point of intuition, results showed that differences in knowledge and academic ability were irrelevant.

Furthermore, regarding the issue of concern over influence from difference in ethnic culture I compared Chinese foreign students with Japanese students, and the results were as follows: regarding the basic problems. both Japanese and Chinese students showed roughly the same tendency as European and American students, but regarding the correction problems, improvement in correct answer rate for the Chinese foreign students was more remarkable than the rise in correct answer rate of European and American students.

About heuristics, I deepen a study and want to grow whether a correct answer rate goes up the way of what kind of question.

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