

Research on Influence of Speed and Gap on a Blind Illusion

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Chapter 1 Introduction

Illusion has been actively explored in the fields of perceptual psychology for a long time. This research has achieved many remarkable results till today. But so far, the purpose of the research has been focused on observation of illusion phenomena and characteristics of illusion, not on reasons of illusion which is, the authors believe, require a large amount of detailed information on quantity. In this study, our team develop a novel method for quantitative determination, and simulate the phenomena of different falling speeds and different intervals of the blind strips on a computer. We collect all the data and analyze them on quantity, and try to explore the reason of illusion. We hope to speculate human perception system further through finding out the mechanism of illusion.

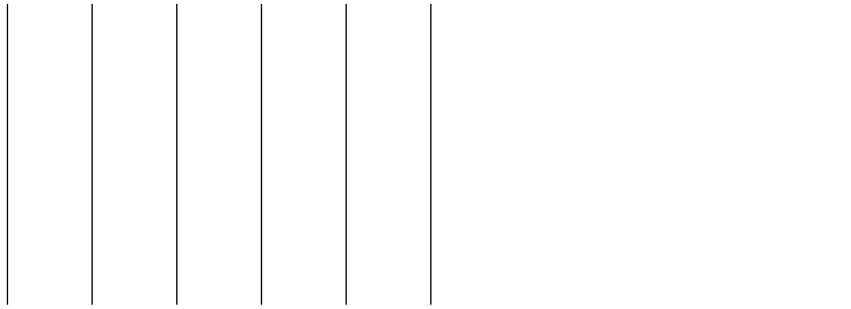
When one person observes an object, he is often perceived. The object that he feels is not what it actually is. It has many reasons, such that the colors that an object appears in different lights are different, the shapes that an object appears from different directions are not the same, there are different physical and psychological states in different observers, and so on. This is an illusion which is ubiquitous. An illusion on vision is called optical illusion and the one on hearing is called auditory hallucination. In psychology, it has a history of 200-300 years on the research of optimal illusion, and it has a history of 150 years on the research of geometrical optical illusion – a branch of optical illusion. The first academic paper on geometric optical illusion in the world was published in 1855 [1], in which the experiments indicated that a line subdivided by a series of short orthogonal ticks appears longer than the same line without been subdivided. This paper is the foundation of geometric optical illusion. Subsequently Zollner illusion was published and Poggendorff illusion [2] were published in 1860. Then in 1861 Hering Illusion [3] was also published. Some achievements on geometric visual illusion based on Oppel's research have been published in the field of experimental psychology.

To sum up, research on illusion has never been interrupted although the purposes and methods of research are various.

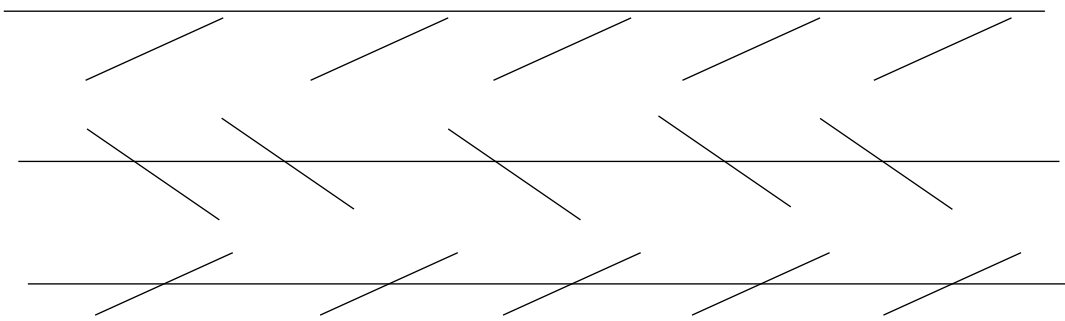
One of many important purposes of research is to elucidate perceptual characteristics of human beings. The study on optical illusion is one of a few methods known as far through which people can explore effectively the analysis mechanism of the brain [4]. In psychophysics, optical illusion is expected to make up for the lack of contact between psychology and physiology. Furthermore, it can help people know about eye movements mechanism in visual system, then understand the structure of brain and how the brain processes visual information. An illusion is a distortion of an objective thing under certain conditions [5]. It is not a pathological phenomenon. Many researchers believe that the brain neglects part of all the information sometimes when it faces too huge information to accept and conduct in time, which leads to illusion.

The other important purpose is how to use the optical illusion effectively. For examples Fig. 1, trompe l'oeil which is often found around us intends to exploit amount of optical illusion to make works artistic, while the construction of the Parthenon temple utilizes a large number of parallax corrections which intend to reduce illusion, and parallax correction has also been applied to avoid traffic accidents. In the future things can be developed in ideal directions by applying theories of optical illusion.

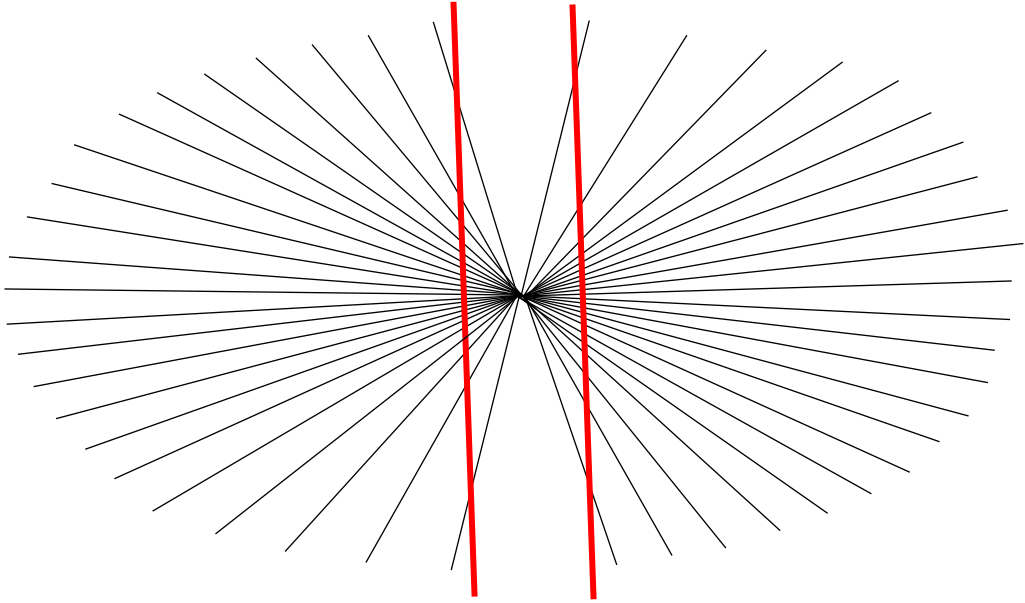
The occurrence of optical illusion is not immutable, and it has a great relationship with the characteristics of an observer, such as occupation [6], experience on illusion [7], observation quantity [8] and so on. Therefore it is necessary to choose the same observers as a test group in order to acquire some objective conclusions in experiments on optical illusion tests. Japanese scholars studied one of the factors that affect the optical illusion: observation quantity over and over again. [9] They divided all the observers into trained and untrained teams, tested them on the three aspects of color composition, plane composition, and three-dimensional structure. They compared the results of the two teams and drew a conclusion that the errors of the trained team are fewer than those of the untrained team. Overfitting on illusion may change the information processing method of human's eyes and brain and change the experiment results on optical illusion. Thus overfitting should be avoided.



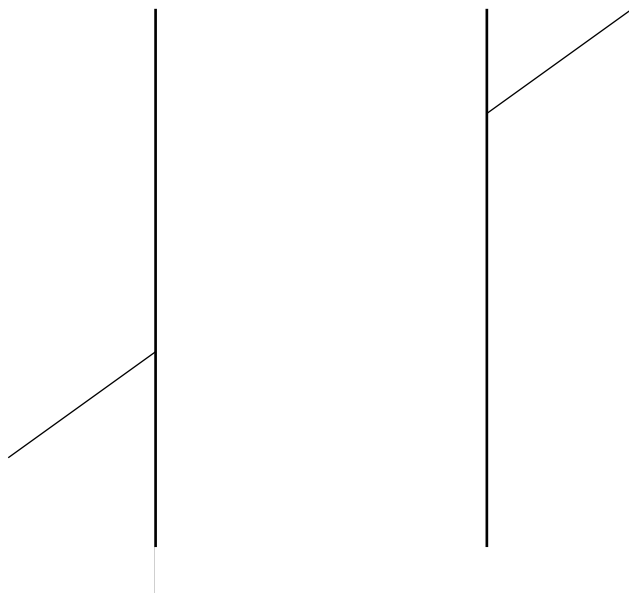
(a) Opper-Kundt illusion



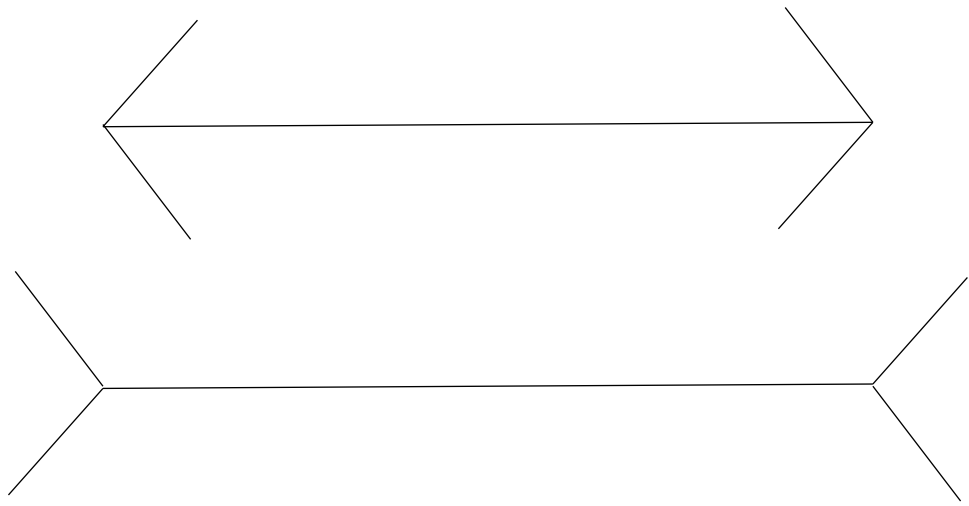
(b) Zollner illusion



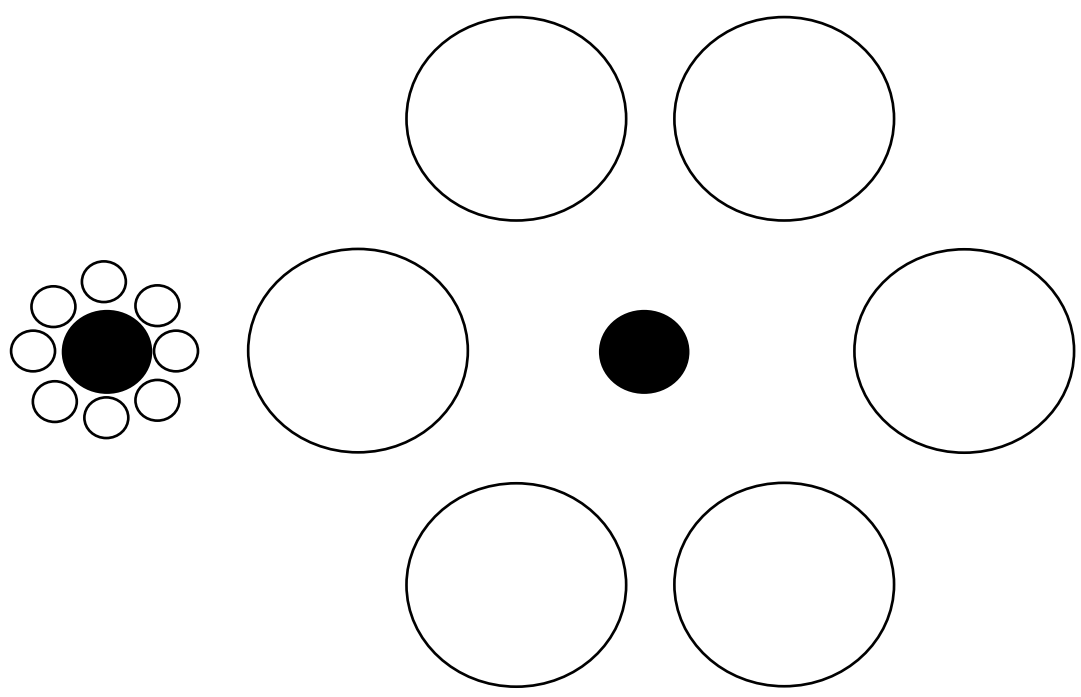
(d) Hering illusion



(c) Poggendorff illusion



(e) Müller-Lyer illusion



(f) Ebbinghaus illusion

Fig. 1An example of geometrical illusions

Chapter 2 Blind Illusion

In 2013 we found a new phenomenon : the falling speed of snowflakes which is felt by people through partially blind window are faster than the one without any blinds, which is called 'Blind Illusion'. People has little research on the novel optical illusion, and doesn't know the exact reasons of the illusion. Consequently we decided to explore the phenomenon. We simulated this phenomenon on a computer, seen as Fig.2. In this figure, a light spot represents a grain of snow, and a grey rectangle represents a piece of blinds. In previous research, Miyajima et al[10]. discussed the apparent movements and the pursuit eye movements in blind illusion, Jinye et al[11]. verified the effect of luminance difference in blind illusion. These research results show us some relevant factors which can affect blind illusion, and then we will explore further other factors.



Fig. 2 Blind Illusion Model.

2.1 Relationship with speed

Following the previous simulations, some grey horizontal strips simulate the blinds and some white light spots simulate snowflakes, and experiments are carried out on a black background. From the experiments we can know that the average falling speed that the observers see from a blind window seems 0.3-1.0 deg/s faster than the actual one 2.0 deg/s. Thus we deduce that 'speed' is an important factor in blind illusion. In this paper we'll discuss the various falling speeds of snowflakes in experiments, and explore the relationship between falling speed and illusion quantity.

2.2 Relationship with width of a blind strip

In addition to falling speed, the width of a blind strip is another important factor that affect blind illusion. As a result, we take the factor into account, and change the width of blind strips in the experiments to explore the relationship between width of a blind strip and illusion quantity.

2.3 Purpose

Our research purpose is to find out what kind of processing mechanism our brain use to produce 'Blind Illusion' phenomena. Hence, we experimented with the two factors: the falling speed of snowfalls and the width of blind strip. For the former, we will verify the relationship between falling speed and illusion quantity. For the latter, we will adjust the width in order to test the boundary points of illusion. Following the previous experiments, we will adjust the speed of the white spot and the width of the blind strip in the study.

Chapter 3 Experiment I

The purpose of this experiment is to investigate how the falling speed of snowfalls affects blind illusion. A white spot simulating a grain of snowfalls moves from the top of the black screen to the bottom and experimental participants observe the falling speed with a blind and without a blind. We will record the various results at the various falling speeds and analyze the illusion quantity

3.1 Equipment and environment

A liquid crystal display (LCD) is selected as the prompt device in this experiment, and its parameters are shown in Table 1. The experimental equipment is shown in Fig. 3. The experiment will be carried out in a darkroom which prevents interference from outside light. A participant sits at a viewing distance of 600 mm from the LCD computer screen and his head is fixed with a chin support. The answer button is put on the experimental table near the observers' hands. Five adults with good vision take part in this experiment.

Table 1 Parameters of LCD

Type	LCD-AD172SEB
Size	17 inch
Maximum range	338mm×270 mm
Resolution	1280pixel×1024 pixel
Maximum refresh frequency	75 Hz

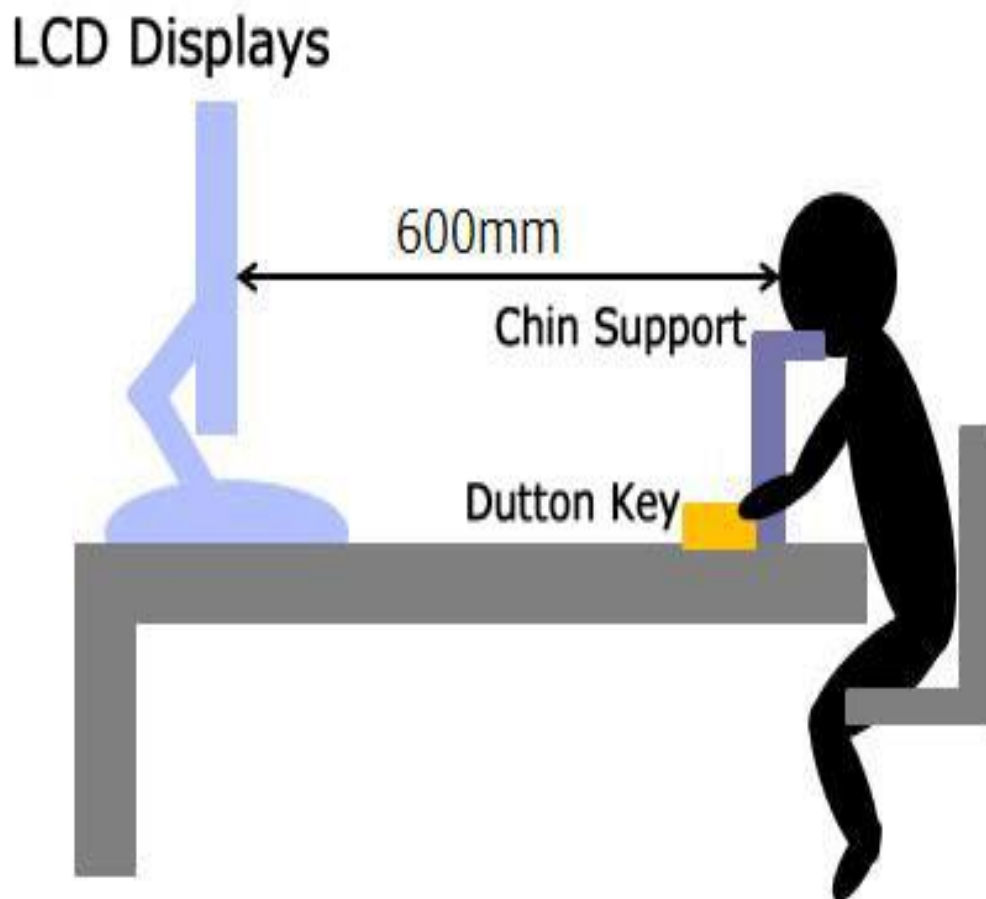


Fig. 3 Experimental equipment

3.2 Stimuli

Stimuli is shown as Fig. 3. The black screen (RGB = 0, 0, 0) as the background is divided vertically and equally into two sides. A red spot with a diameter of 0.1 deg (RGB = 255, 0, 0) is set in the center of the screen as the central fixation point in order to suppress eye movements. In the center of the left and right sides there are white spots with a diameter of 0.1 deg. The experiment of the left picture without blinds is defined as standard stimuli, while the one of the right picture with blinds is defined as comparison stimuli. In the right there is a grey (RGB = 128, 128, 128) rectangle on the top of the picture and there is the same one on the bottom. They are blind strips and there is an interval with 0.4 deg width between them. In standard stimuli, the white spot will move at a constant speed from the top of the screen toward the bottom along a vertical line. The moving speed varies from 2.0deg/s to 4.0deg/s, with an interval of 0.5deg/s. In other words, it has 5 values. In comparison stimuli, the white spot will fall from the top to the bottom. But its moving speed is variable. Its initial speed will be set according to the result of the preliminary tests, which is slower than or as the same with the one in standard stimuli.

Standard stimuli

Comparison stimuli

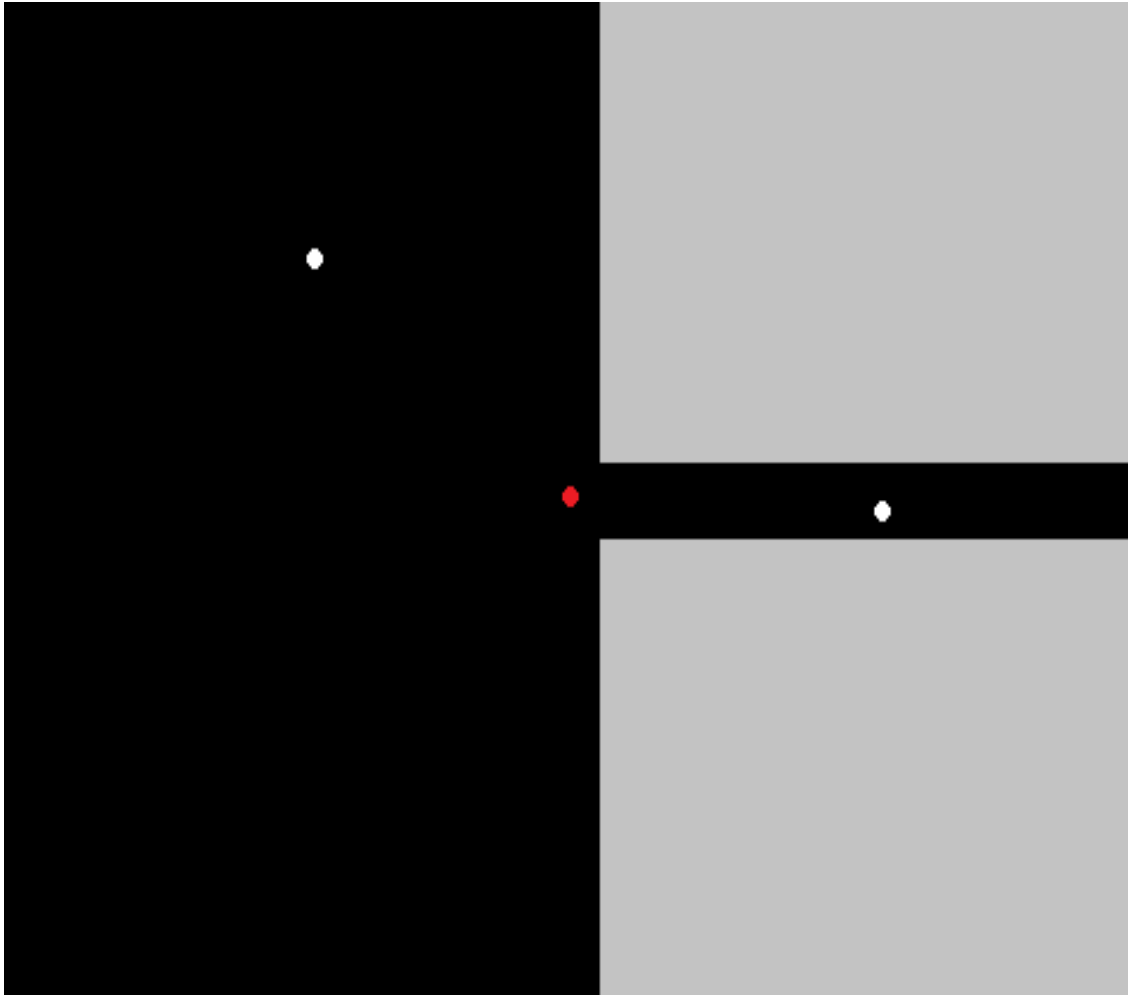


Fig. 4 Stimuli.

3.3 Methods and Procedure

In the experiment a participant will firstly sit for one minute in the darkness, then stare at a black screen for one second, and finally he can watch a picture as Fig. 3. The participant will press the corresponding button according to the results he observes. If he feels that the spot in the comparison stimulus drops faster than the one in the standard stimulus, he will press the 'quick' key; otherwise he will press the 'slow' key. If he thinks the two speeds are equal, he will press the 'equal' key. The experimental procedure is shown in Fig. 5.

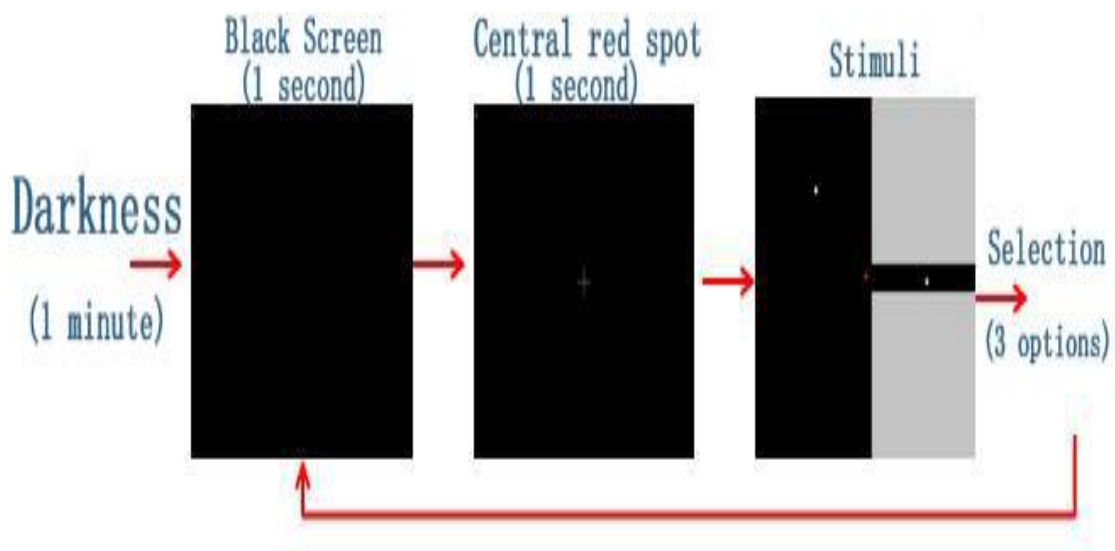


Fig. 5 Experimental procedure.

The method of limits is used as test method in this experiment. There are two phases: increasing and decreasing. [12]The spot in standard stimuli remains a constant falling speed which is randomly chosen from Table 2. Table 2 describes 5 speed values in standard stimuli and their corresponding initial speed in increasing and decreasing phases. In increasing phase, the white spot in the comparison stimuli will start at a

slower initial speed which corresponds to the one in standard stimuli, then speed up at the rate of 0.1deg/s. In decreasing phase, the white spot in the comparison stimuli will start at the same speed as the corresponding one in standard stimuli, then slow down at the rate of 0.1deg/s. Tests begin with the increasing phase. And in such an increasing phase if the participant reflects the speed in the comparison stimulus is faster than the one in the standard stimulus for the first time, a counter plus 1; otherwise the counter is cleared to 0 and the next test remains in the increasing phase but the initial speed needs to be randomly chosen. If the counter gets to 3, the next test skips to the decreasing phase, and the test procedure in the decreasing phase is similar to the one in the increasing phase.

Table 2 Initial speed in comparison stimuli

Speed in standard stimuli	2	2.5	3	3.5	4
Speed in comparison stimuli (increasing phase)	0.2	0.4	0.6	0.8	1.0
Speed in comparison stimuli (decreasing phase)	2	2.5	3	3.5	4

3.4 Results and analysis

The experimental data according to the method of limits is collected and analyzed. We calculate the values of upper limen, lower limen and point of subjective equality (PSE) for each set of data. The value of upper limen has two cases: 1) In increasing phase, it is an average value of the speed at which the participant presses the ‘equal’ key for the last time and the one at which the participant presses the ‘quick’ key for the first time; 2) In decreasing phase, it is an average value of the speed at which the participant presses the ‘quick’ key for the last time and the one at which the participant presses the ‘equal’ key for the first time. Similarly, the value of lower limen has two cases: 1) In increasing phase, it is an average value of the speed value at which the participant presses the ‘slow’ key for the last time and the one at which the participant presses the ‘quick’ key for the first time; 2) In decreasing phase, it is an average value of the speed value at which the participant presses the ‘quick’ key for the last time and the one at which the participant presses the ‘slow’ key for the first time. The value of PSE is an average value of the upper and lower limen values. Consequently, we will acquire the illusion quantity. For each speed of standard stimuli, we implement 10 groups of tests in increasing phase, and then get their average value. We do the same in decreasing phase. Finally we can get the average value of the former average values. The final average is an illusion quantity of the corresponding speed in a standard stimulus. Table 3 records the illusion quantity of 5 participants at different speeds.

We collect all the experimental data and analyze them according to the method of limits. We first introduce 3 concepts which are for each set of tests.

➤ Upper Limen(UL):

In increasing phase, it is denoted as UL_I and is an average of two speed values in comparison stimuli. One is the instant falling speed of the white spot at the time when the participant presses the ‘quick’ key and the answer is right for the first time; the other is the one at the time when the participant presses the ‘equal’ key which is right for the last time. UL_I is denoted as

$$UL_I = (S_{\text{quick,first}} + S_{\text{equal,last}})/2 \quad (1)$$

2) In decreasing phase, it denotes as UL_D and is an average of two speed values which are the instant falling speeds of the white spot at different time in comparison stimuli, too. One is recorded at the time when the participant presses the ‘equal’ key which is right for the first time, the other is when the participant presses the ‘quick’ key and the answer is right for the last time. UL_D is denoted as

$$UL_D = (S_{\text{equal,first}} + S_{\text{quick,last}})/2 \quad (2)$$

- Lower Limen (LL): Similarly, the value of LL has two cases: in increasing phase and in decreasing phase. It is denoted as LL_I and LL_D , respectively. They are calculated as follows:

$$LL_I = (S_{\text{equal,first}} + S_{\text{slow,last}})/2 \quad (3)$$

$$LL_D = (S_{\text{slow,first}} + S_{\text{equal,last}})/2 \quad (4)$$

where $S_{\text{equal,first}}$ indicates the instant falling speed of the white spot in comparison stimuli when the participant presses the ‘equal’ key which is right for the first time. $S_{\text{slow,last}}$ indicates the instant falling speed when the participant presses the ‘slow’ key which is right for the last time. Similarly, the meanings of $S_{\text{slow,first}}$ and $S_{\text{equal,last}}$ can be understood easily.

- Point of Subjective Equality (PSE):

PSE is the average of UL and LL, and also has two cases: in increasing phase and in decreasing one, denoted as PSE_I and PSE_D , respectively.

$$PSE_I = (UL_I + LL_I)/2 \quad (5)$$

$$PSE_D = (UL_D + LL_D)/2 \quad (6)$$

Then we describe what blind illusion quantity (BIQ) is. In short, it is difference between PSE and the speed of the white spot in standard stimuli, denoted as S_{std} , to which the comparison stimuli of PSE corresponds. In this paper, there are 5 different standard speed in Table 2, thus for each participant there are 5 different BIQ, defined specifically as follows

$$BIQ(i) = |PSE(i) - S_{\text{std}}(i)|, i=1,2,3,4,5 \quad (7)$$

$$PSE(i) = (\overline{PSE_I} + \overline{PSE_D})/2 \quad (8)$$

$$\overline{PSE_I} = \frac{1}{n} \sum_{n=1}^{10} PSE_I(n) \quad (9)$$

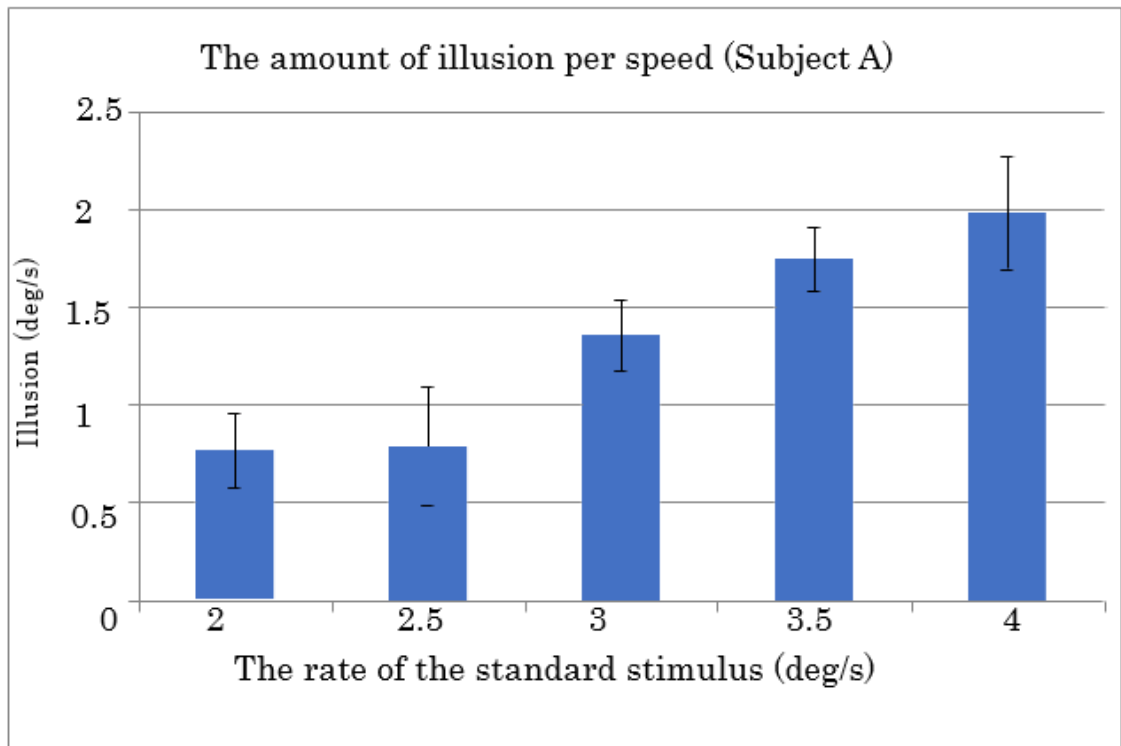
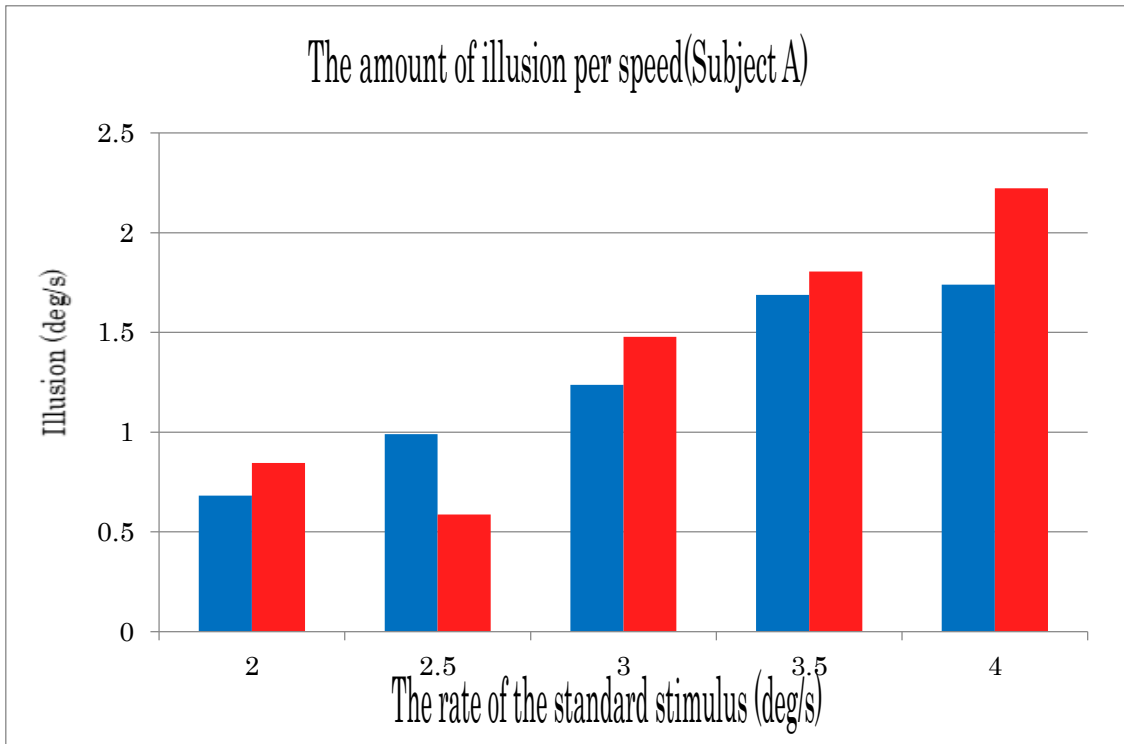
$$\overline{PSE_D} = \frac{1}{n} \sum_{n=1}^{10} PSE_D(n) \quad (10)$$

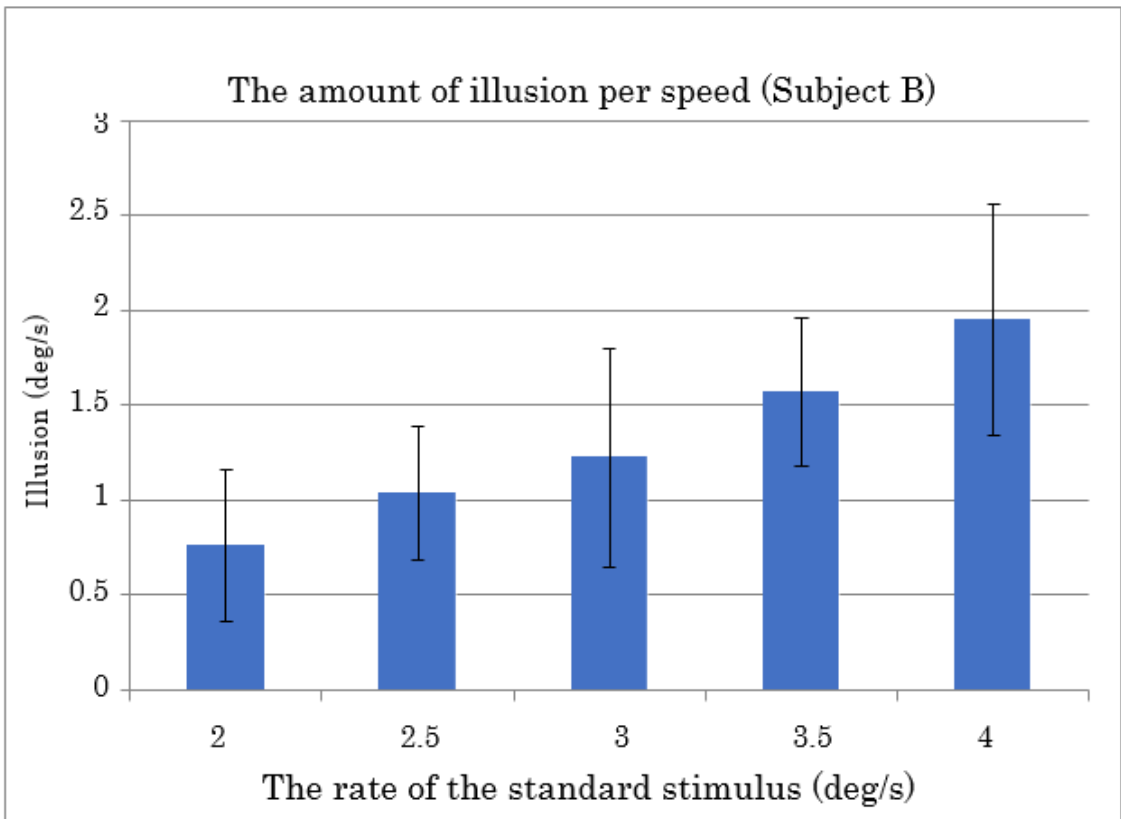
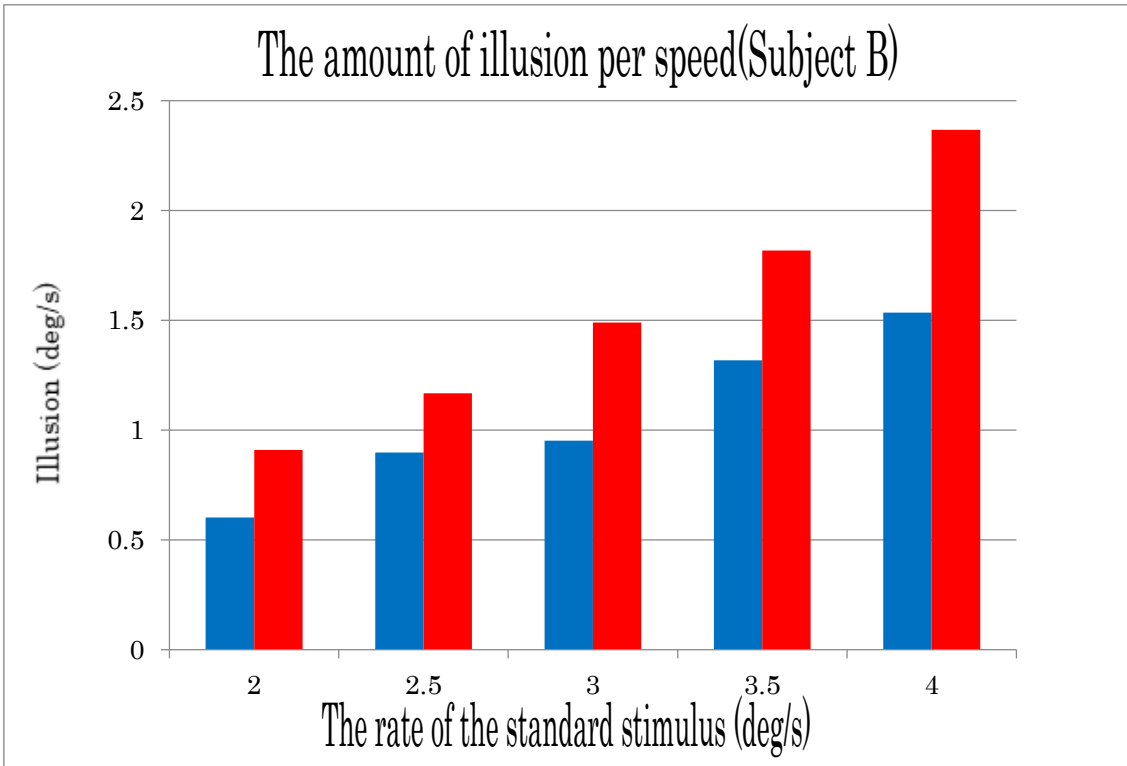
where $\overline{PSE_I}$ and $\overline{PSE_D}$ indicate the average of PSE in increasing and decreasing phases, respectively. Combined (5) and (6), they’re also defined as follows:

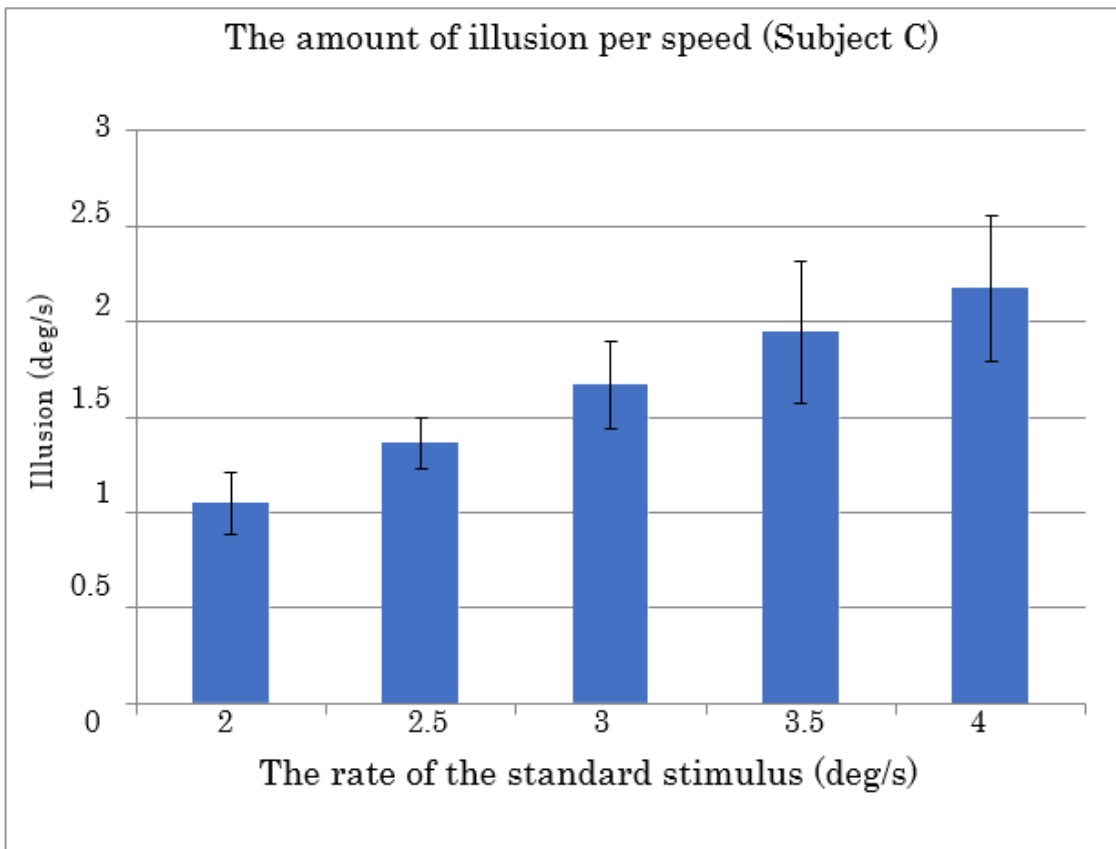
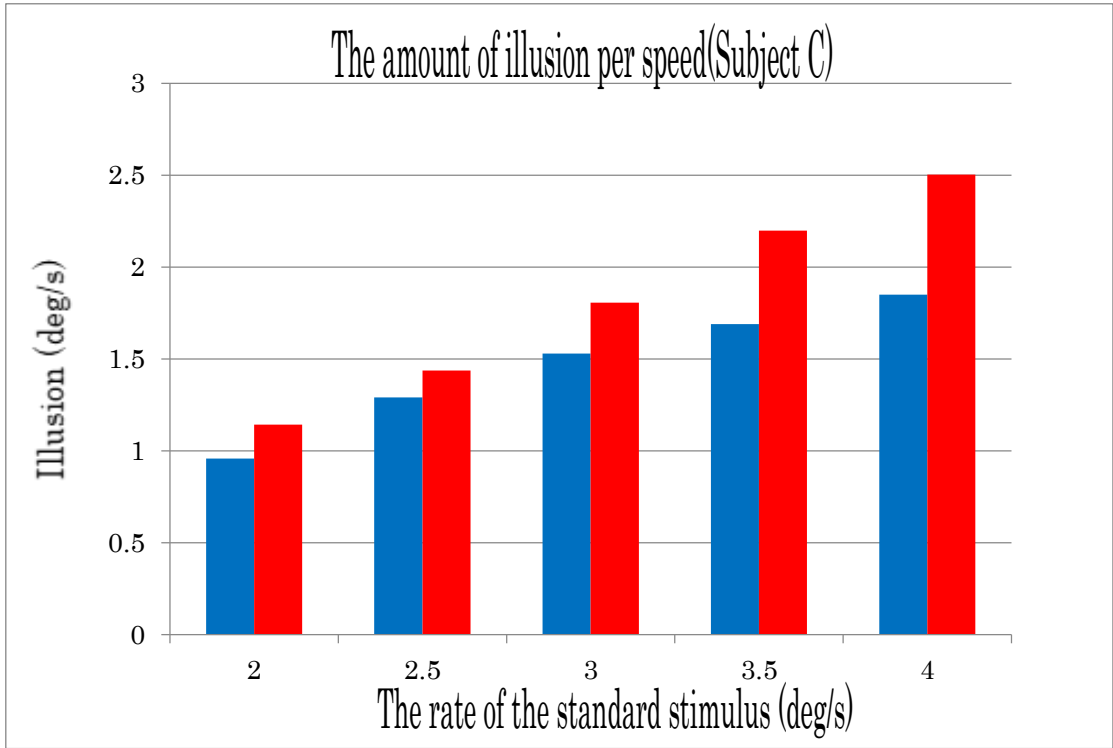
$$\overline{PSE}_I = \frac{1}{2n} \sum_{n=1}^{10} (UL_I(n) + LL_I(n)) \quad (11)$$

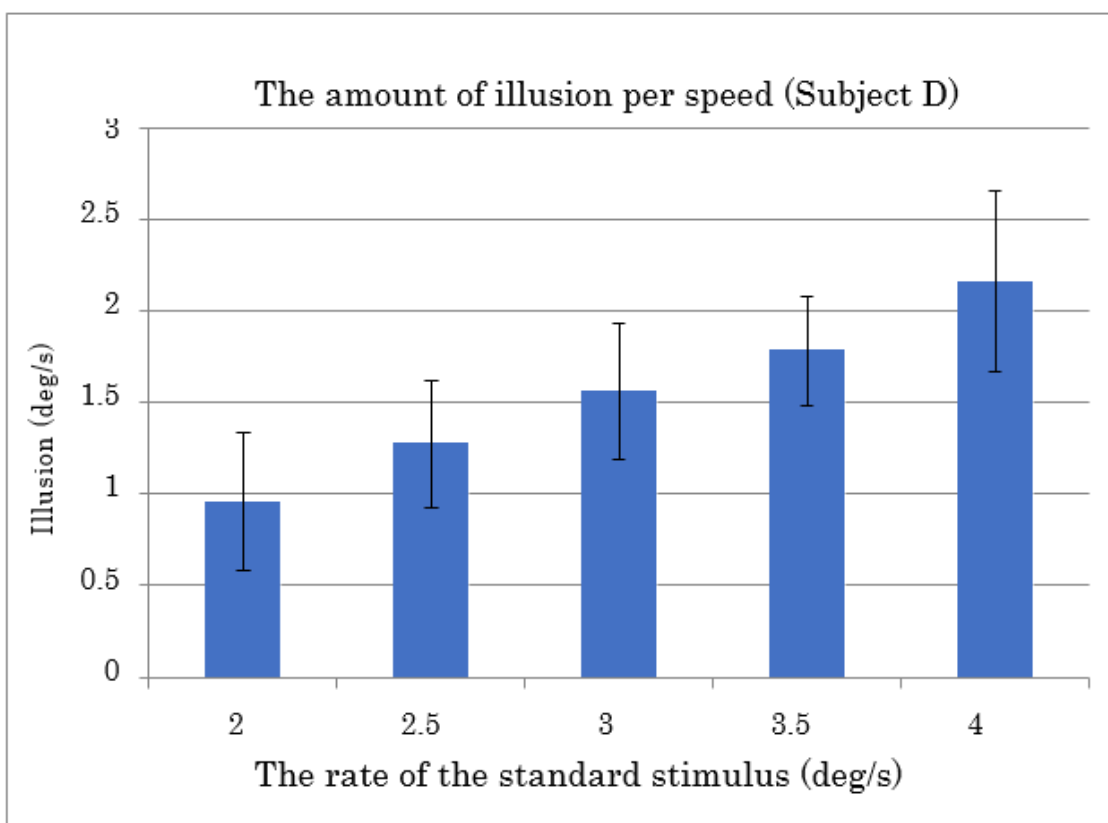
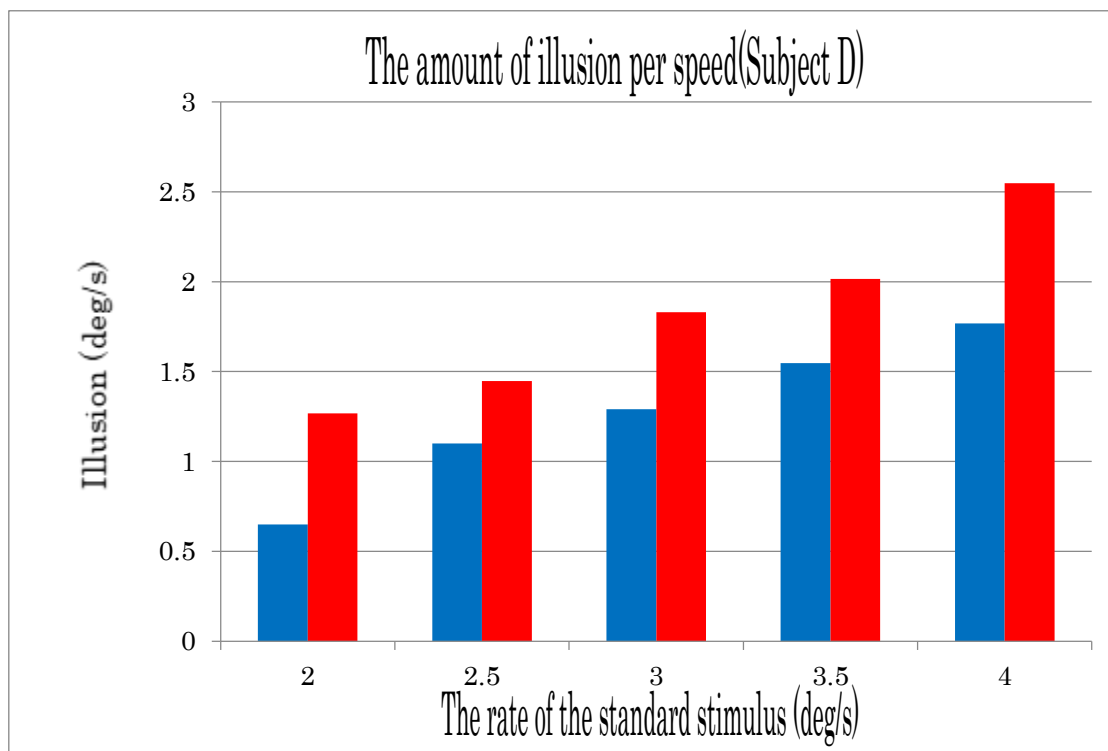
$$\overline{PSE}_D = \frac{1}{2n} \sum_{n=1}^{10} (UL_D(n) + LL_D(n)) \quad (12)$$

Accordingly, we calculate all BIQ values of 5 participants at 5 different standard speeds, listed in Table 3. From Table 3, we can know the faster the standard speed is, the larger the BIQ values of all participants are, although the specific data of each one is different. We further calculate the average BIQ values of each ones at each standard speed and we find the average BIQ is 0.928 when the standard speed is 2.0deg/s, the average one is 2.154 when the standard speed is 4.0deg/s. With the increase of the standard speed, the value of BIQ is increases. Figure 5. shows us the ratio of the falling standard speed to BIQ.









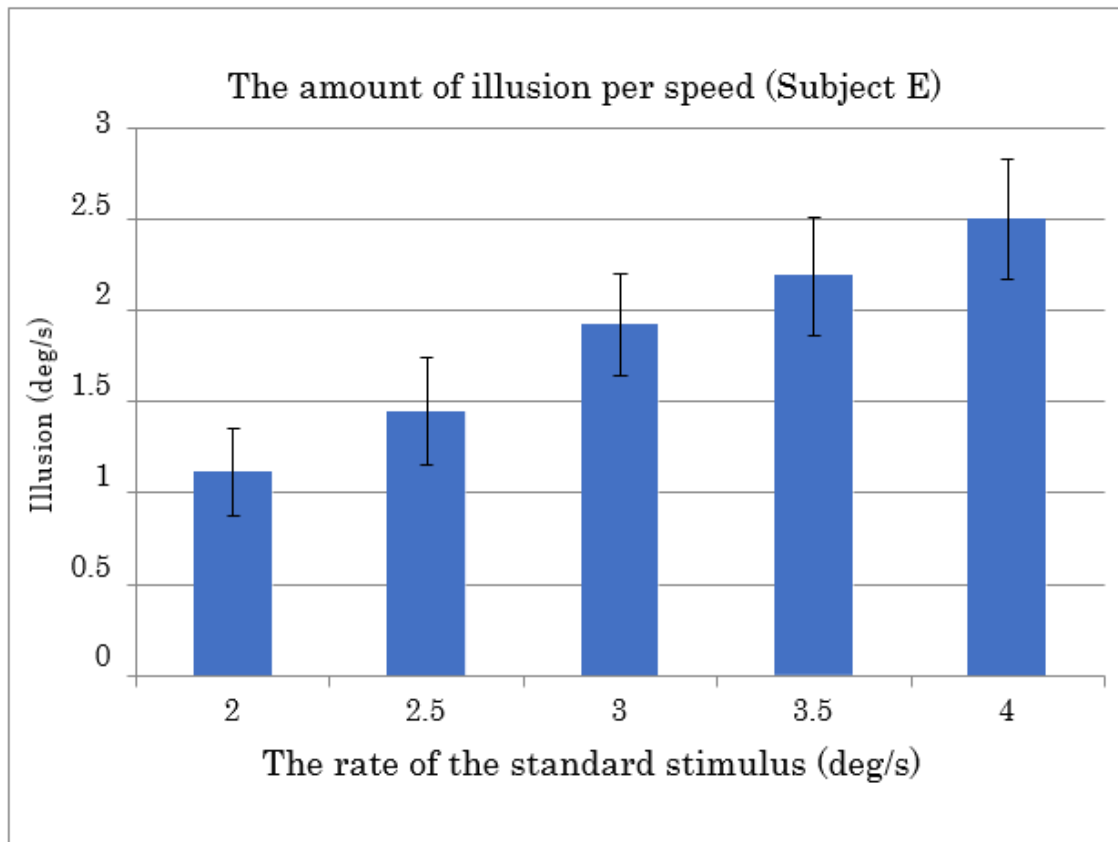
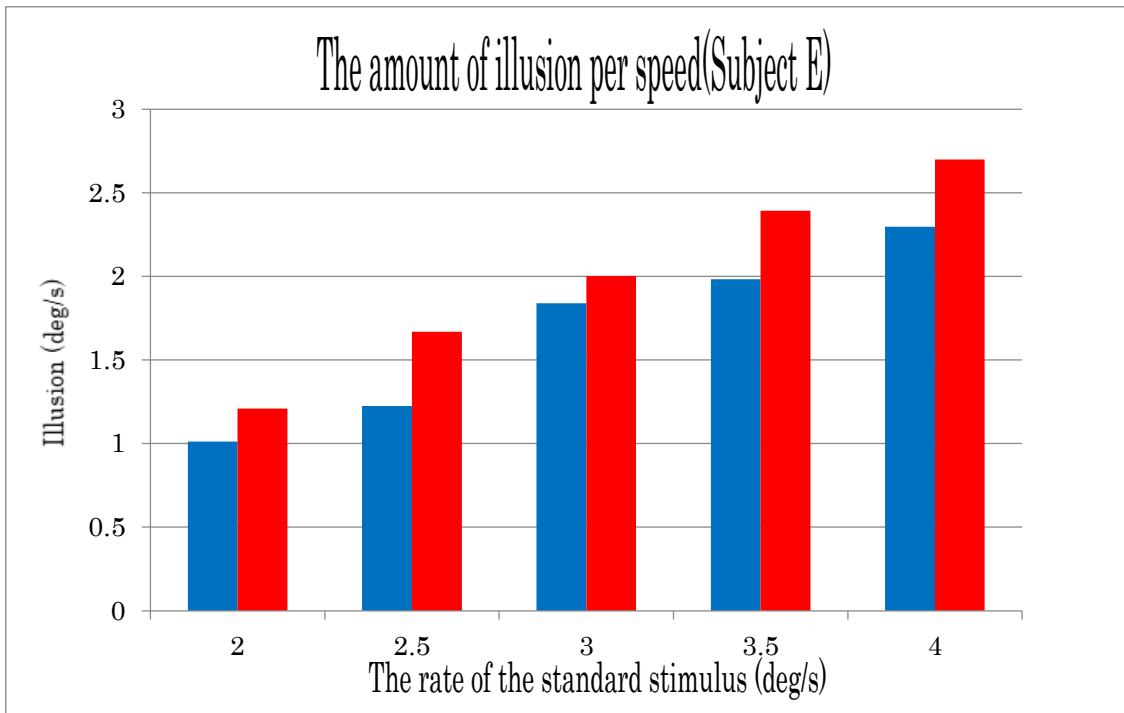
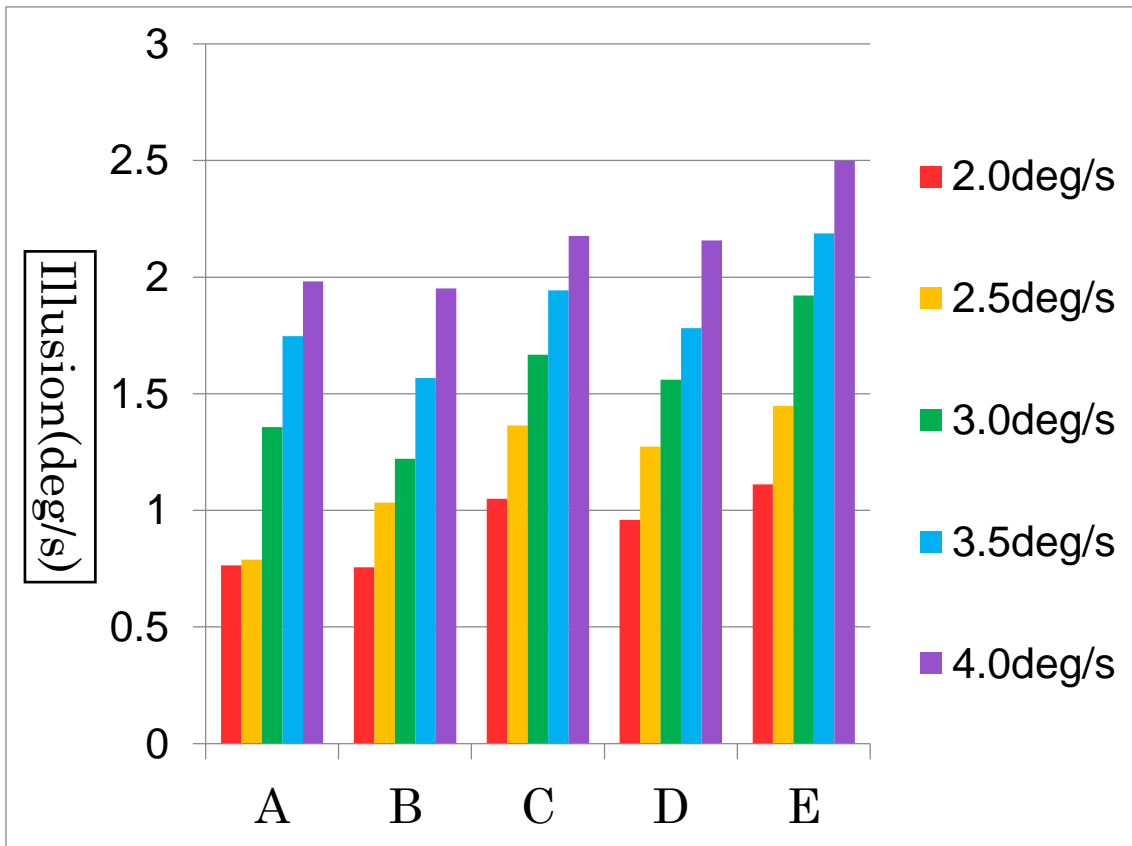


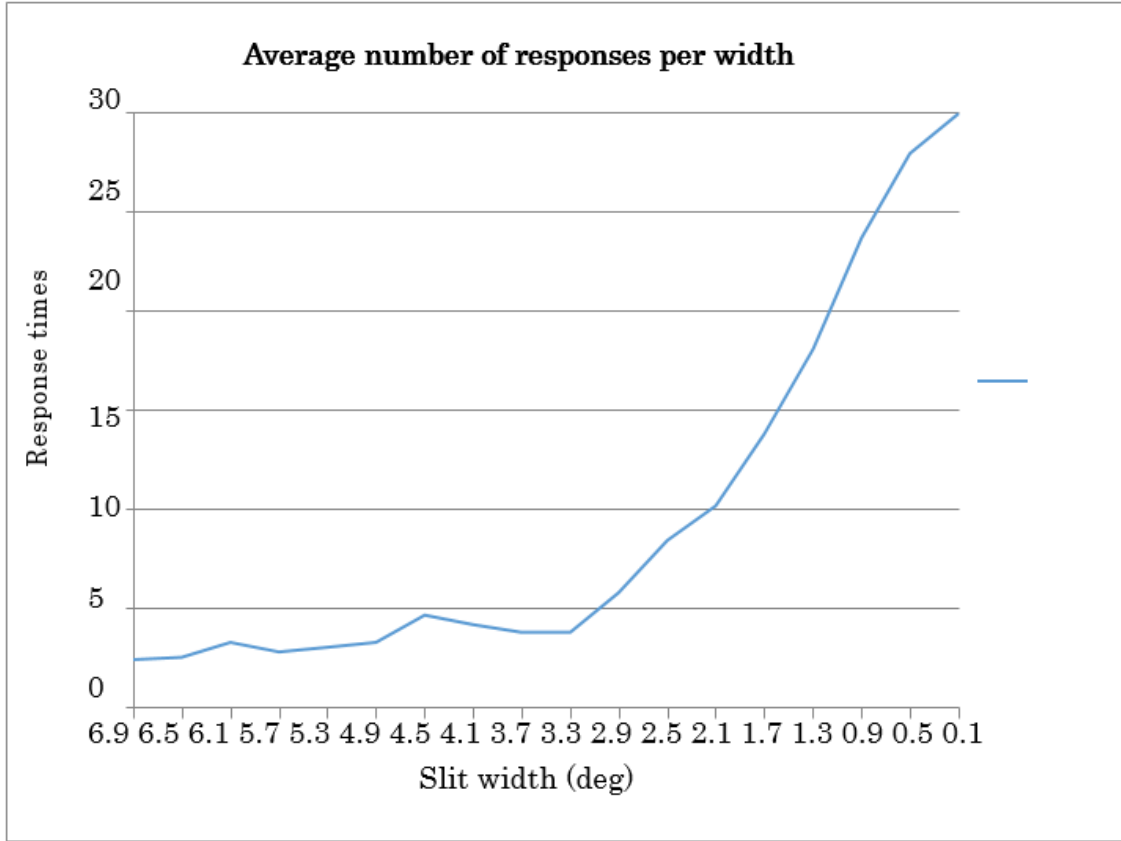
Table 3 Illusion quantity of 5 participants at different speeds (deg/s).

Participants Speed(deg/s)	A	B	C	D	E
2	0.76	0.76	1.05	0.96	1.11
2.5	0.79	1.03	1.36	1.27	1.45
3	1.36	1.22	1.67	1.56	1.92
3.5	1.75	1.57	1.94	1.78	2.19
4	1.98	1.95	2.18	2.16	2.50



Focusing on speed, we found that the average of illusion quantity is 0.93 deg/s when the falling speed is 2.0deg/s, but the average gets to 2.15 deg/s when the falling speed increases to 4.0deg/s. Fig. 5 shows us the ratio of the falling speed to the illusion quantity. It indicates the illusion quantity will increased exponentially as the falling speed increases exponentially.

Although there are some individual differences in these speed experiments on blind illusion, we can get the following conclusions from the experimental data as a whole: 1) In comparative experiments of comparison stimuli with blinds and standard stimuli without blinds, it is generally believed that the speed in the former is faster than the one in the latter. Moreover, the amount of illusion increases as the speed of the standard stimulus increases. That is to say, the faster the white spot moves, the more likely it is to produce an illusion. 2) The illusion quantity is different because of different genders. In general, men are more likely to have delusions of speed than women. 3) The illusion quantity in increasing phase is significantly higher than that in decreasing phase although the increasing and decreasing experiments are alternating. We speculate that perhaps it is the method of limits makes the testers have a prediction of trend, a habit of judgement, which is the drawbacks of the method of limits [13].



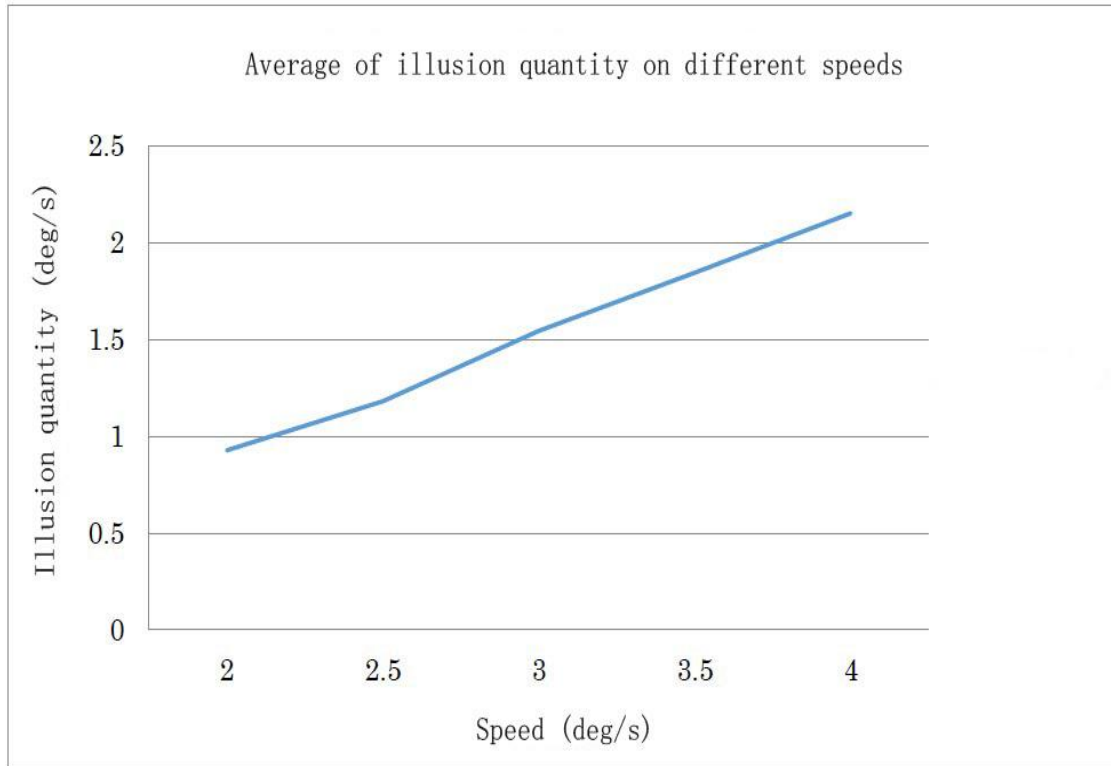


Fig. 6 Average of illusion quantity on different speeds.

Chapter 4 Experiment II

In experiment I we can see that the falling speed of the spot affect blind illusion. In addition, we have noticed the fact the width of the blind strips may have an effect on blind illusion. Therefore, we will verify the above deduction.

4.1 Equipment and environment

The equipment used in this experiment and the required experimental environment are approximately the same as experiment I. We need the same computer with LCD, darkroom, bench and other equipment as Experiment I. Unlike Experiment I, the selection device to answer will change from 3 keys to 2 keys. And participants in this experiment will be 8 adults with good vision.

4.2 Stimuli and methods

The stimuli in Experiment II is also roughly the same as that in Experiment I. The left of the screen shows standard stimuli while the right shows comparison stimuli. The two parts of the screen select a white spot with a diameter of 0.1deg to simulate a grain of snow and the white spots will drop at the speed of 2.0 deg/s from the top of the screen to the bottom, respectively. In comparison stimuli, the width of the blind strips starts at 0.1 deg, gradually increasing 0.4deg each time, and ends at 6.9 deg. That is, it has 18 values to test. We choose constant method in this experiment. The experimental procedure is described below: A participant sits at a viewing distance of 600 mm from the LCD computer screen in a darkroom. He first sit quietly for one minute, then watch the black screen for one second, and then star at the spot for one second, and in the last begin to test. In comparison stimuli, the width of the blind strips will be chosen from the 18 values randomly. The participant have only two answers: one is that the speed in comparison stimuli is faster than the one in standard stimuli, the other is that the speed in

comparison stimuli is equal to or slower than the one in standard stimuli. The screen turns black for one second after one participant finishes one selection, and then begin to show the next stimulus. The 18 widths of the blind strips repeat 30 times respectively, thus each participant will experience 540 tests.

4.3 Results and discussion

We note that the narrower the interval between the blind strips, the more prone to the illusion. With the narrowing of the field of view, the moving time crossing the interval shortens, which give us an illusion that the white spot moves quicker. We speculate that our brain can acquire a little information about the moving white spot due to the very narrow interval, and it complete the moving trajectory of the white spot during the flash itself. The less visual information, the more likely the illusion will arise.

We collect and analyze the test data of 8 participants, then acquire an approximate curve based on the logistic regression model, shown in Fig. 6. In this figure, the vertical axis indicates the percentage of the respondents who feel the speed in comparison stimuli is faster than the one in standard stimuli, the horizontal axis indicates the width of the interval in comparison stimuli. The approximate curve is drawn according to the true data which comes from the answers of all the participants in the experiment. Meanwhile we define three indexes: upper threshold is the value of the horizontal axis when the value of the vertical axis is 75%; low threshold is the value of the horizontal axis when the value of the vertical axis is 25%; difference threshold is the value of the horizontal axis when the value of the vertical axis is 50%. It is the horizontal values represents the width of the interval. Therefore the illusion quantity will increase when the width value is smaller than difference threshold; otherwise it will decrease. If the width value is smaller than upper threshold, the illusion quantity will increase significantly; if the width value is bigger than low threshold, it will decrease significantly. By calculating the experimental data, we can know the average upper threshold is 0.91, the average difference threshold is 2.14 and the average low threshold is 2.35. The three

threshold values of the 8 participants is shown in Table 4.

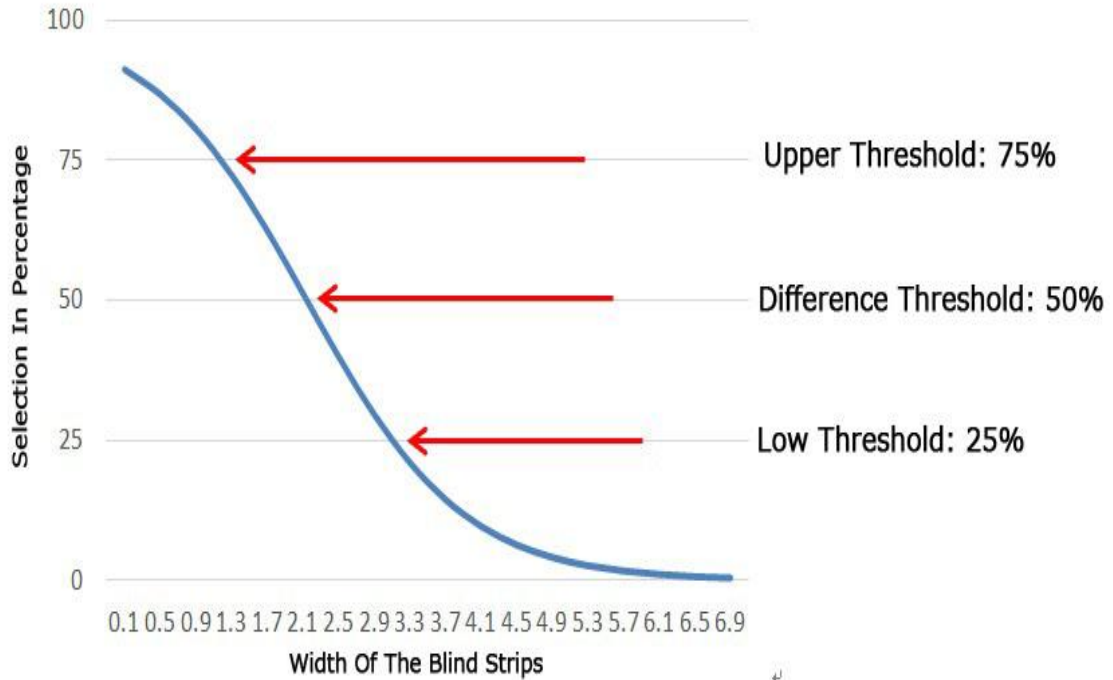
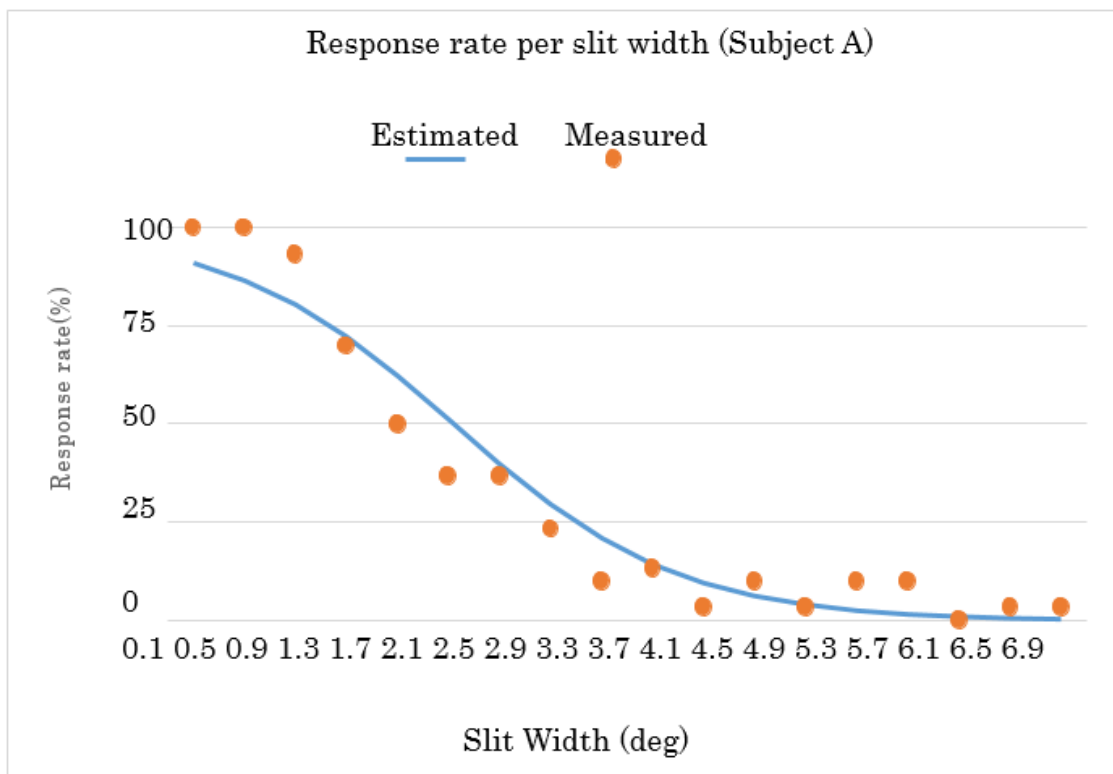


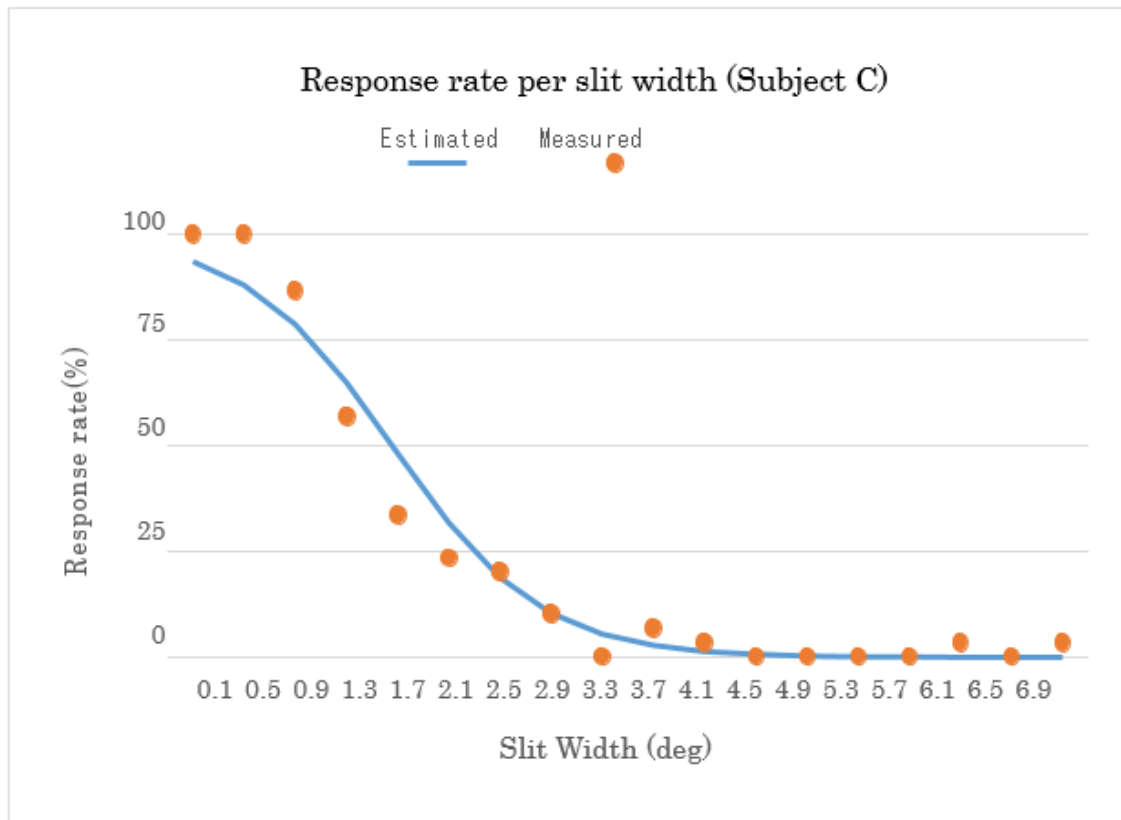
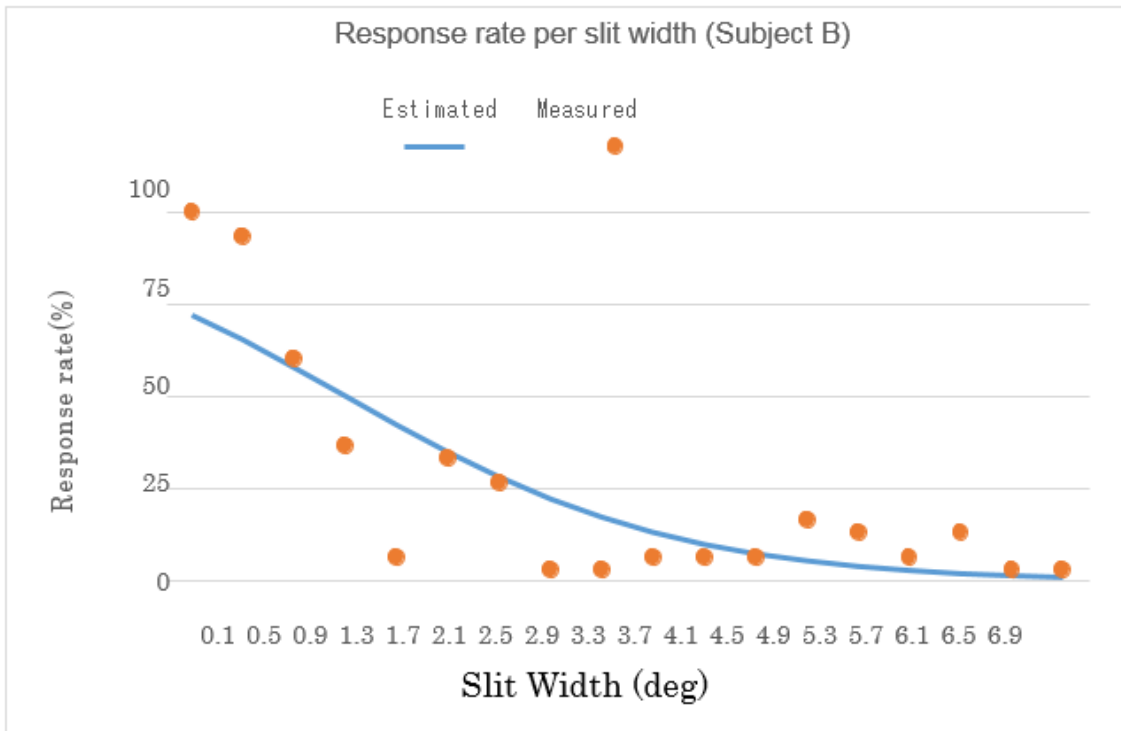
Fig. 6 Approximate graph

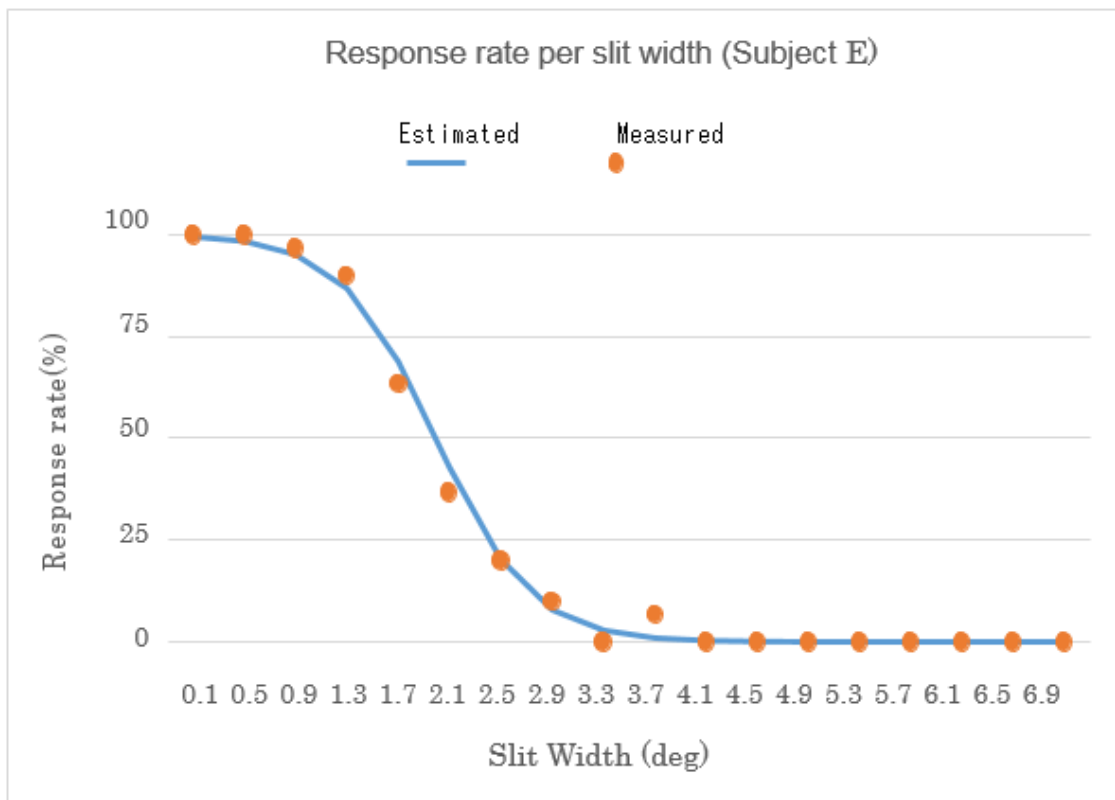
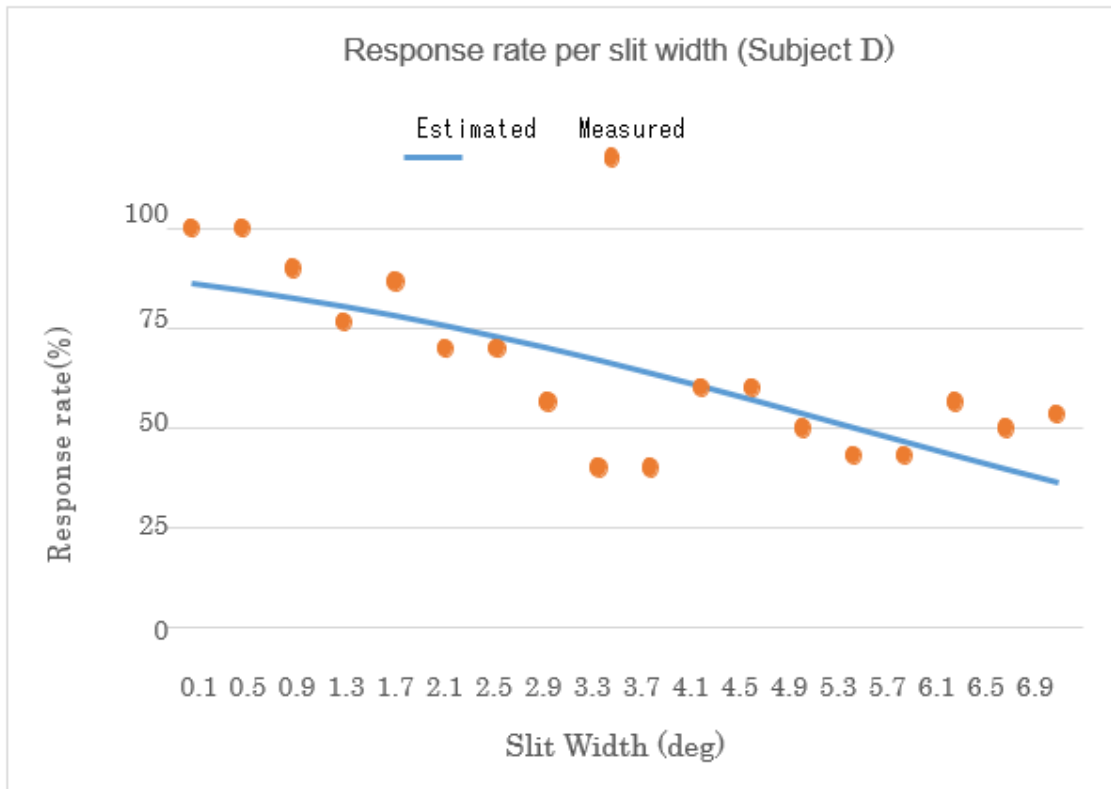
We noticed that the results of the fourth testers were different from those of the others. The upper threshold of Tester 4 is much bigger than those of the others. And the letter O in this table represents that his low threshold is out of range. We set the maximum spacing of the blind strips to be 6.9 deg, which is lower than the reflection point of Tester 4. His low threshold is about 8.5 deg according to his experimental approximate curve. We judge Tester 4 is a special individual who is not sensitivity to this illusion. In this table the letter N represents we did not obtain the upper threshold values of Test 2 and 6. For the tests of Test 2 and 6, we found the illusion quantity decreases in the range of 0.9~2.1 deg and cannot acquire the accurate values. In future experiments we must widen the interval of blind strips so as to avoid the result like the one of Tester 4. But the wider interval will lead to much more test times and bring much burden on

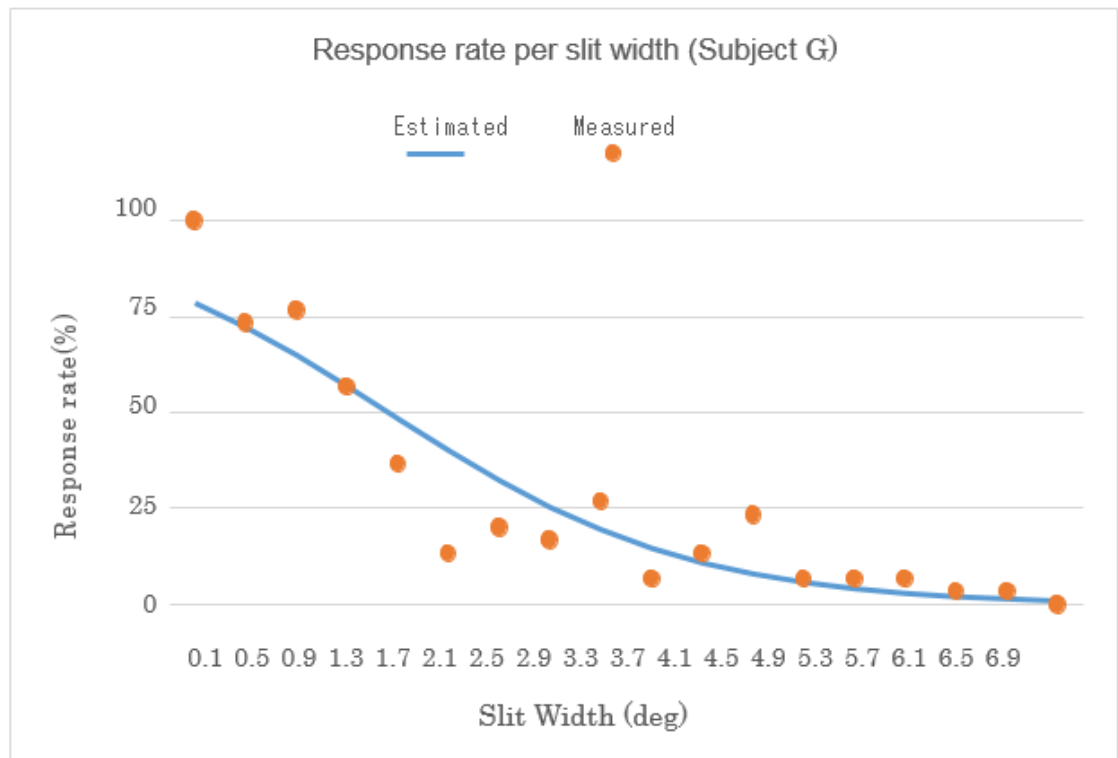
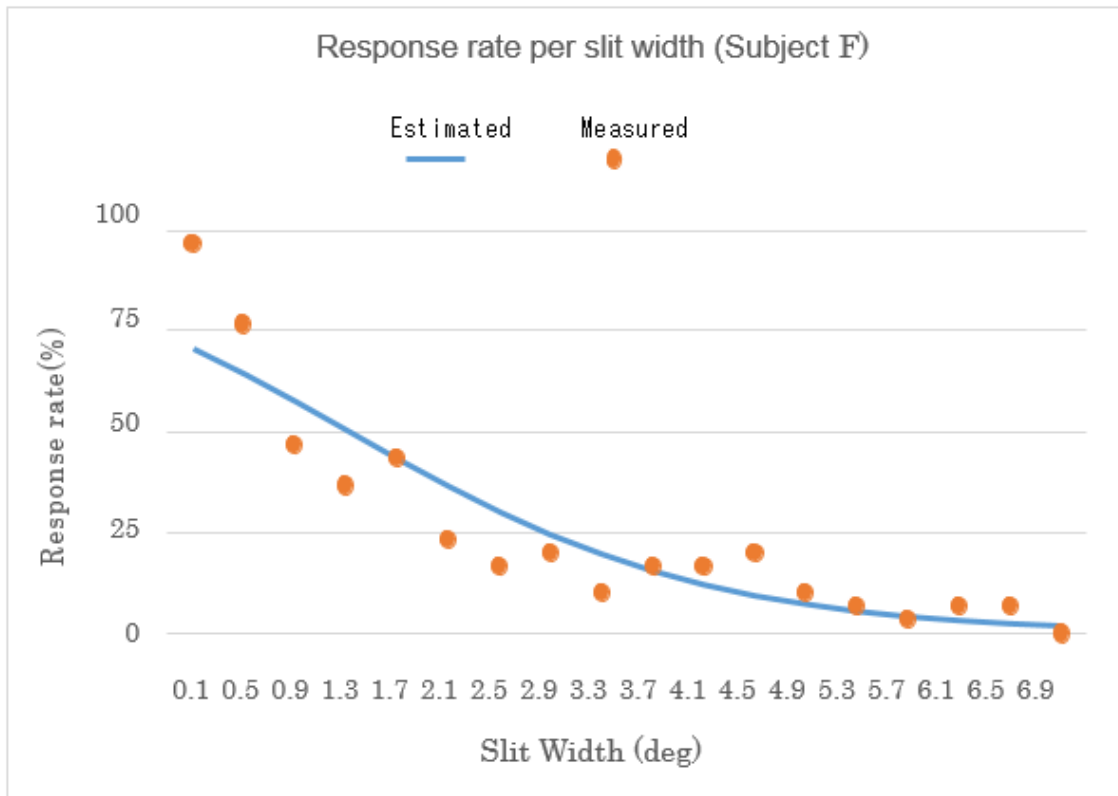
participants, thus we need to discuss how to balance them.

Combined the falling speed of snowflakes in Experiment I, we found that the faster falling speed increases the illusion quantity, and the narrower interval of the blind strips also increases the illusion quantity. We need to further explore the relationship between the former two factors.









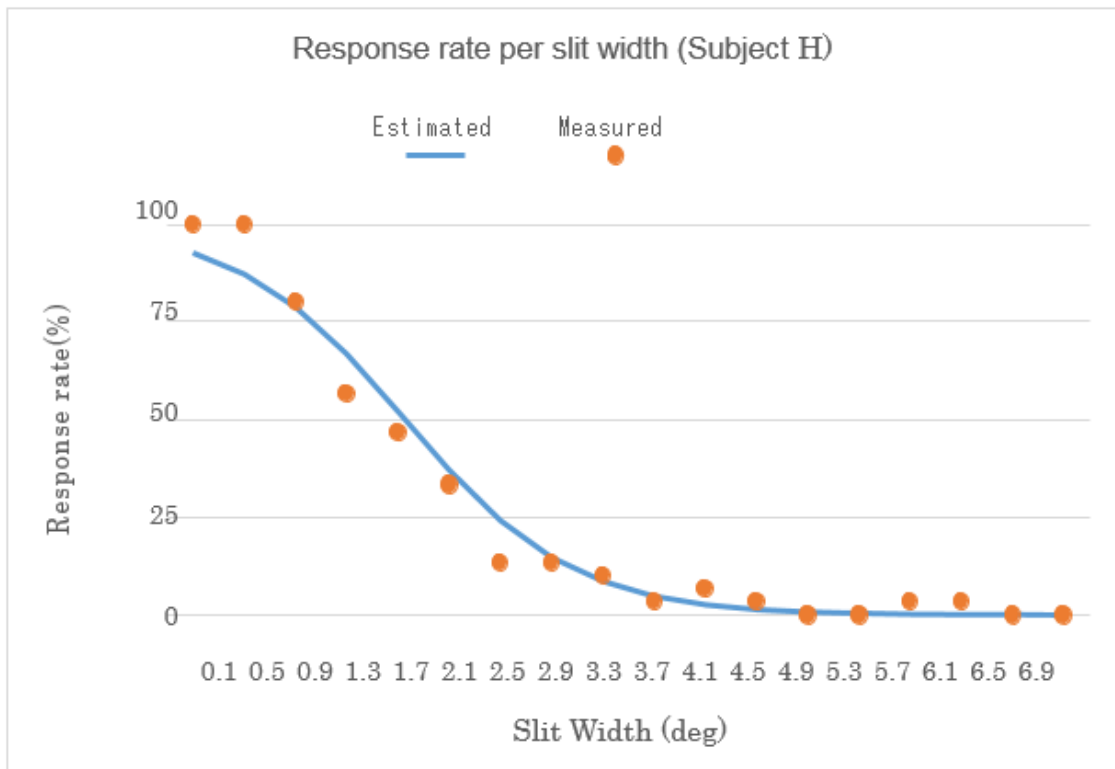


Table 4 Three threshold values of the 8 participants

	T1	T2	T3	T4	T5	T6	T7	T8
Upper threshold	1.17	N	1.01	2.17	1.56	N	0.32	1.03
Difference threshold	2.14	1.30	1.66	5.30	1.99	1.31	1.63	1.76
Low threshold	3.13	2.72	2.31	O	2.41	2.86	2.92	2.48

Chapter 5 Experiment III

To reproduce the new speed illusion in this study research experience with optical illusions ever discovered from natural phenomena, using a computer. Experiments using the computer more, more than the real world and the real world that quantitatively measure the speed illusion, under a variety of conditions, we clarify the mechanism of optical illusion and that, guess the Visual information processing in the brain of unknown structure from.

5.1 Equipment and environment

Produce lab until world speed optical illusion due to the natural phenomenon discovered by the applicant using a computer as a major snow fall exceeds the reality from the real world, to reproduce on a computer, like speed, angle like, size you like, like the blind number, like blind width.

Experiments relative to the rate of fall of the snow didn't make the blinds to Windows and window blinds hanging at the same time, didn't make a blind window under conditions, have adjusted by as fast as baseline, to measure the difference between the reference value as the speed illusion.

Determine if the measured speed illusion cause illusions. That illusion happens in what conditions the illusion does not happen in any condition to reveal. Quantitative analysis or illusion that significant further how to change the criteria, or change the conditions to which reduces the illusion. Visual information processing in the brain of unknown structure and inferred from the elucidation of the mechanism of optical illusions.

Contributed to the 20-something college student 10 people, healthy subjects.

Computing environment used in experiments is described in table 5

Table 5 computing environment

CPU	Inter(R)core(TM)2 Duo E7300@2.66GHz
Memory	2.00GB
Type of system	64-bit operating system

This experiment provides color display (EIZO co., Ltd. "FlexScan T761"). Monitor's specs are listed in table 6. Than I thought angle was not too optimistic and quite good good, up and down left and right. The Eizo Nanao Corporation seems to be rather strong colors of the color.

Table 6 monitor specs

Type	Deferment	Screen size	19 inches
Screen type	Trinitron	Vertical frequency	50–160kHz
Bitch	0.25mm	Horizontal frequency	30–115kHz
RES	1600×1200	Width x height x depth	452×455×478mm

5.2 Stimuli and methods

Subjects, provide two types of stimuli.

Stimulus 1 were a random dot pattern of white drawn on a 2D plane. This is a moving, the perception that it is snowing. Stimulus 1 diameter 1 deg, number of 2000 pieces, speed is 0.5 deg / s.

Stimulus 2 plus horizontal blinds model line; Stimulus 2 shall can adjust the number of blinds. Stimulus 2 height varies depending on the number of blind 128 deg until from 0.25 deg.

Feel the show at the same time stimulating one and two exciting subjects and subjects equal each other's stimulus stimulated only operated. Adjust the number of blinds shall free.

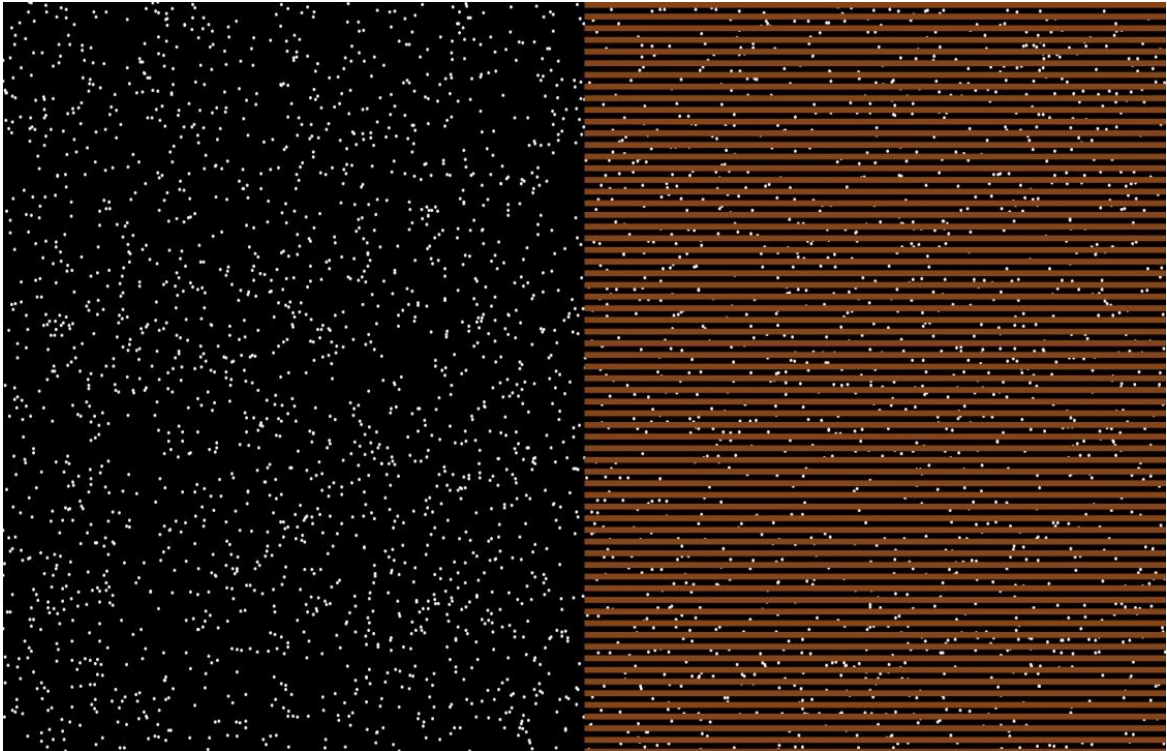


Figure 7. Animation

Create a lab until world speed optical illusion due to natural phenomena were discovered, using the computer as a major snow fall exceeds the reality from the real world. As shown in Figure 7, installing speed optical illusions lab screen two computer monitor screen. One is seen from the window blinds didn't make snow pattern, set as a speed reference reference. Another pattern of snow from window blinds to make are those seen in the blinds and blinds range, such as variable. To allow, respectively, the rate of fall of snow. You can produce, under a variety of conditions not exist in the real world from the real world environment.

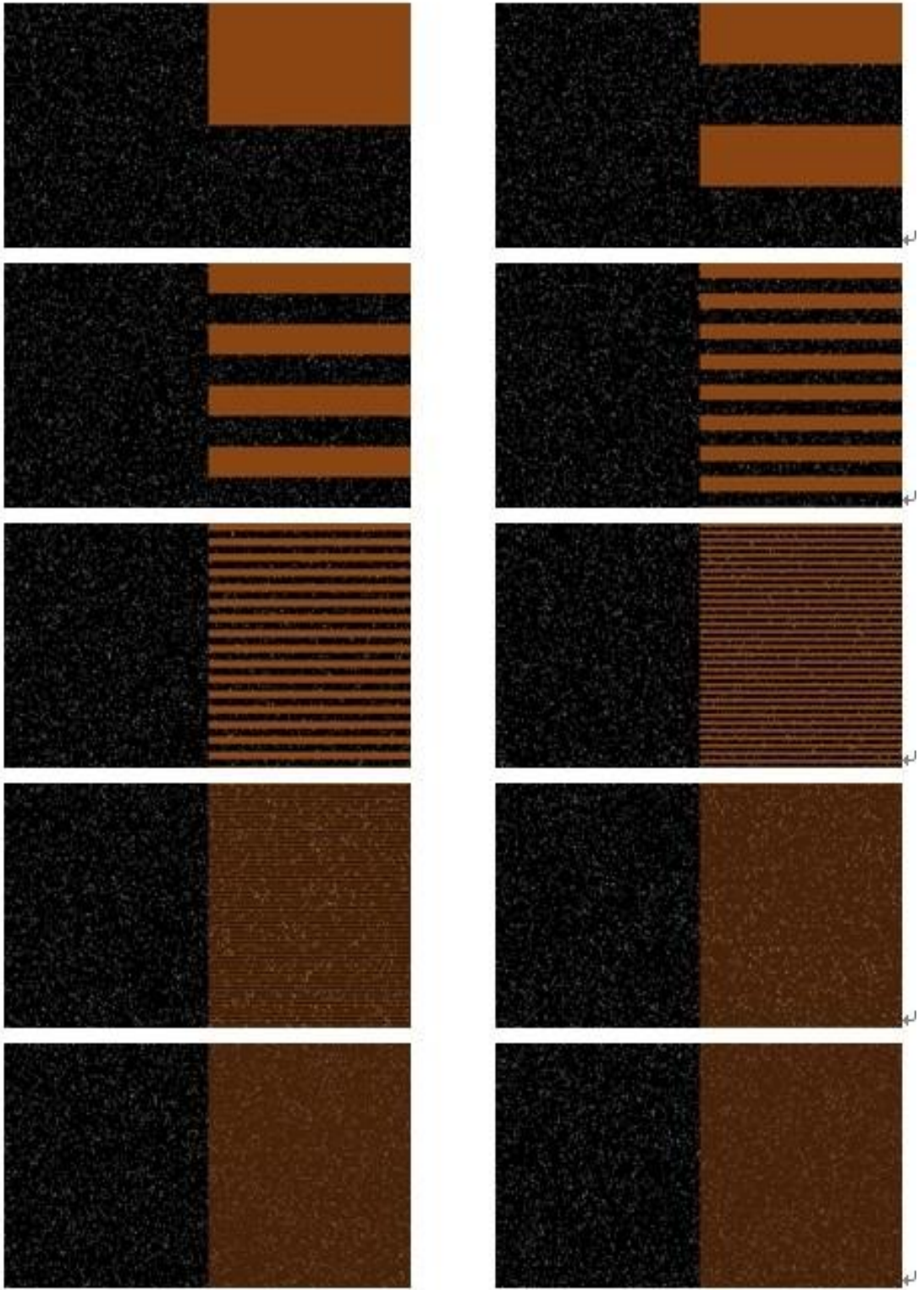


Figure 8 Blind number

One experiment subjects have determined whether or not, shown in Figure 8 first as the number of blind one on the screen, an illusion. If the illusion twice to increase the number of blind, if not. Also, make sure could feel the illusion. Street, number keeps increasing. At the time was an illusion, and adjust the number of stops. From that point, begin adjust the speed of the snow in the right screen. I think from the beginning left screen snow speed mismatch screen snow speed relative to get adjusted. If the stops working when I think both screen snow speed matches the speed variation. Continue to experiment in this way, will increase the number of blinks. And the variation of the number of each record. Once the number of blind to the limits of the screen, the experiment was over. Monitor use this experiment not only 512, so to end experiment at 512.

5.3 Test results

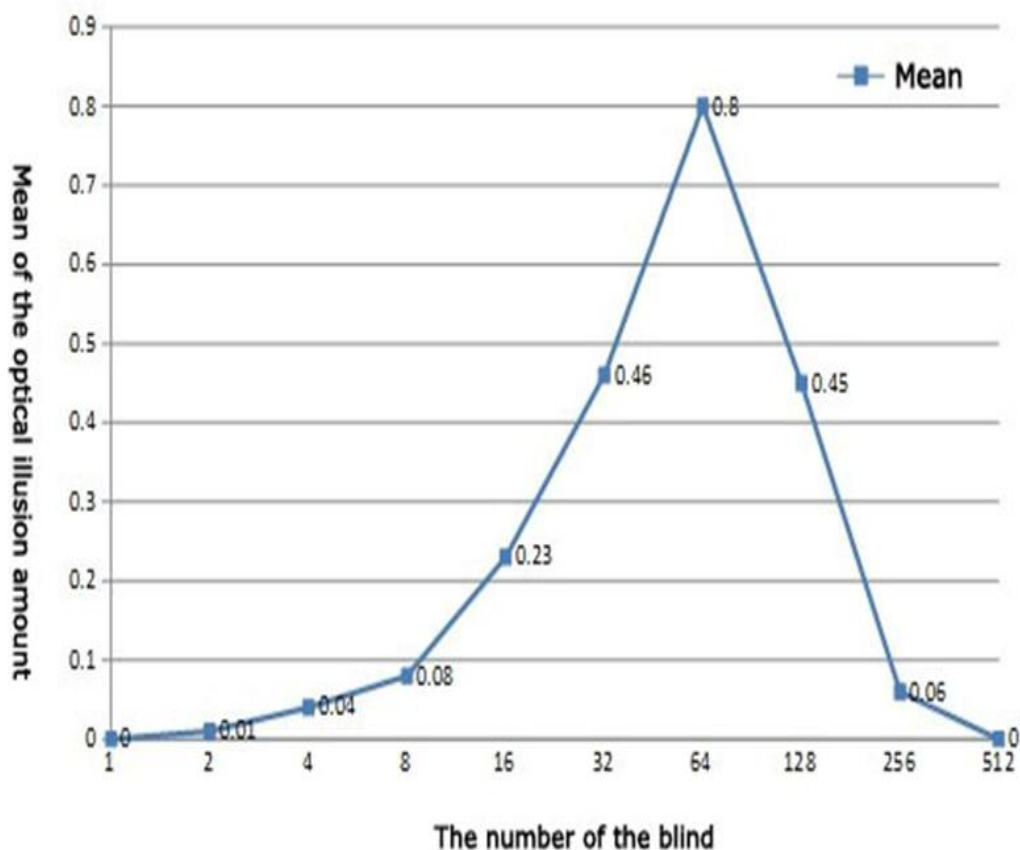
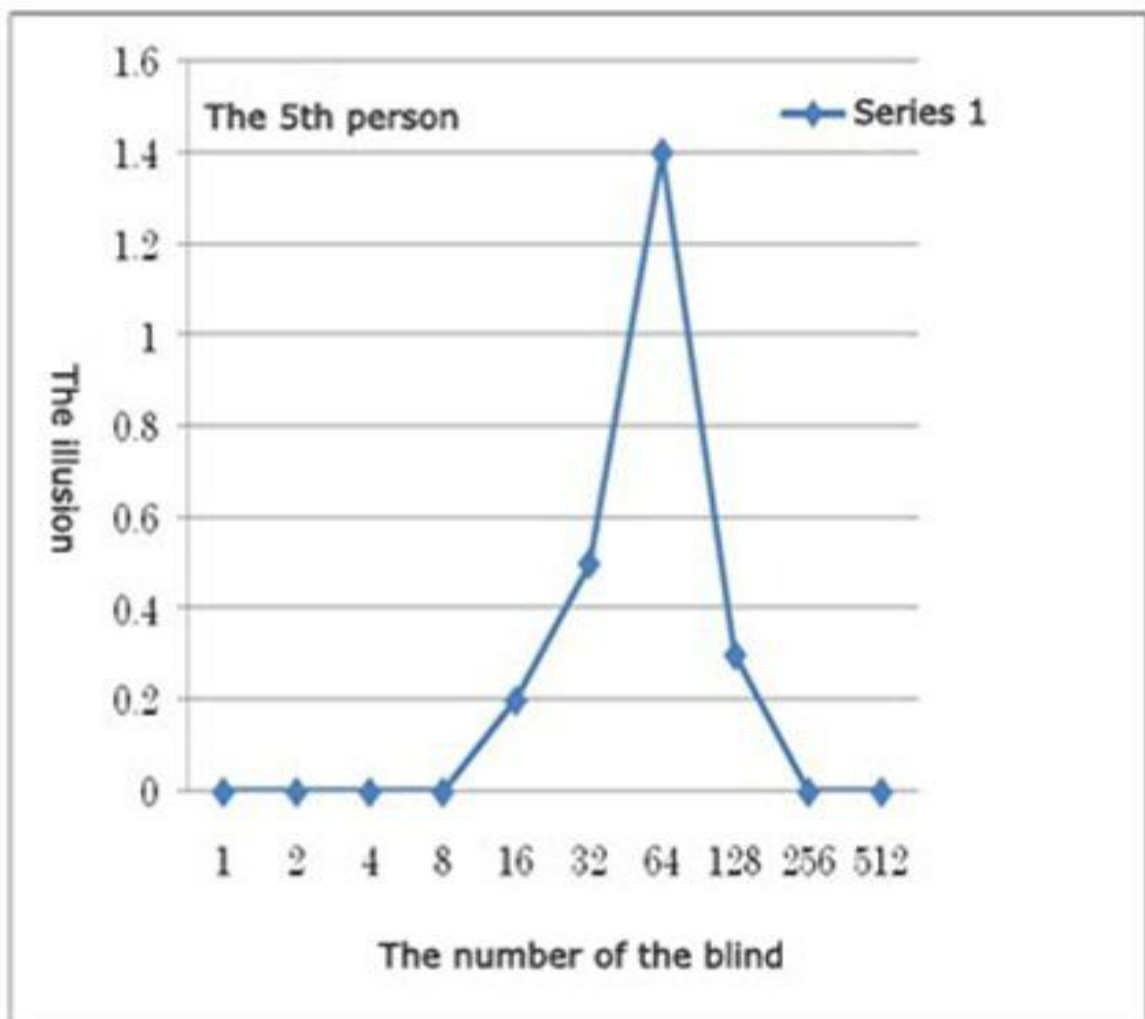


Figure 9. On the mean data of the 10 subjects.

People may feel when one illusion is blind as the display shown in Figure 9, not at all. Between the number of blind increases from two to eight little less much illusion. However, that illusion of increases. Then, between blind increase from 8 to 64 in illusions of suddenly grew. And, it was 64 when the blinds are most feel the illusion. Decreased rapidly and consists of 64 512 increases further, the blind illusion. Expected by the number of blind illusion of change. Increase the number, the greater the illusion of. And was as expected any less an illusion once a certain number of things. 64 photos, when the biggest illusion of results obtained.



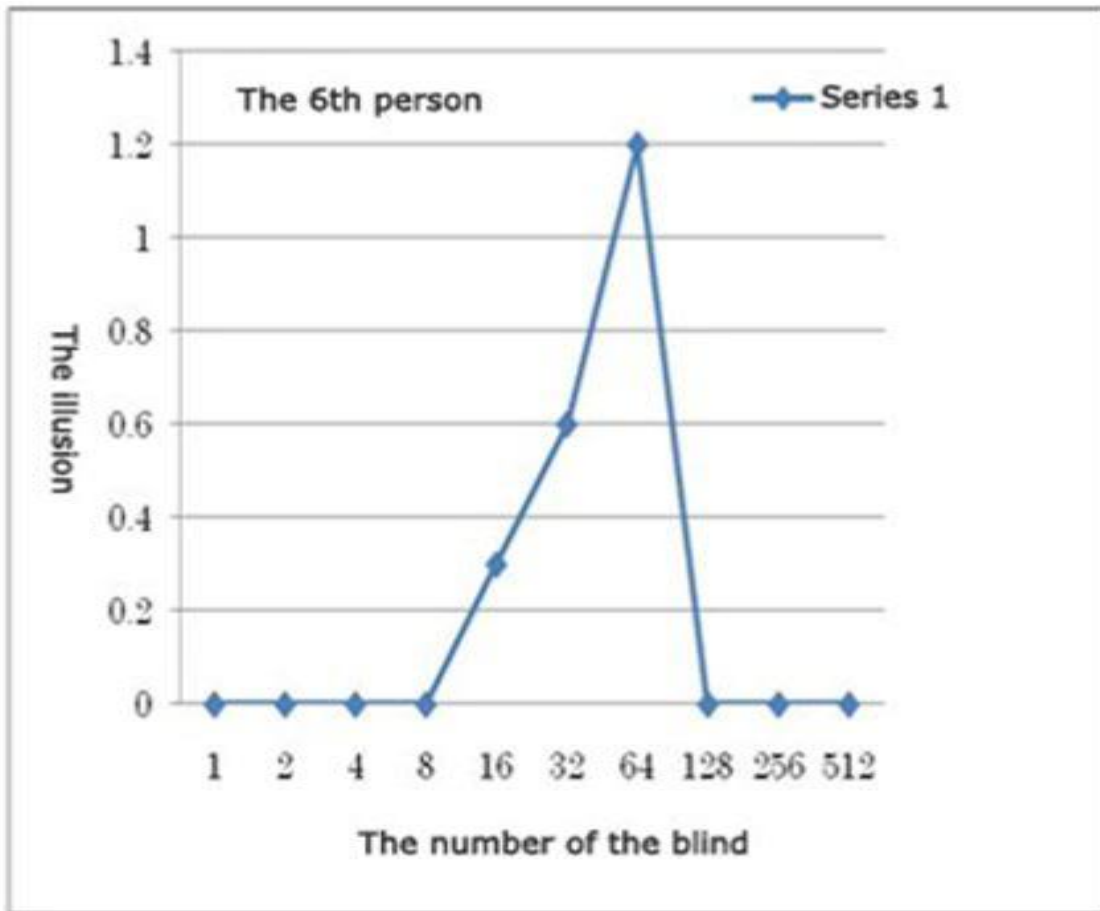
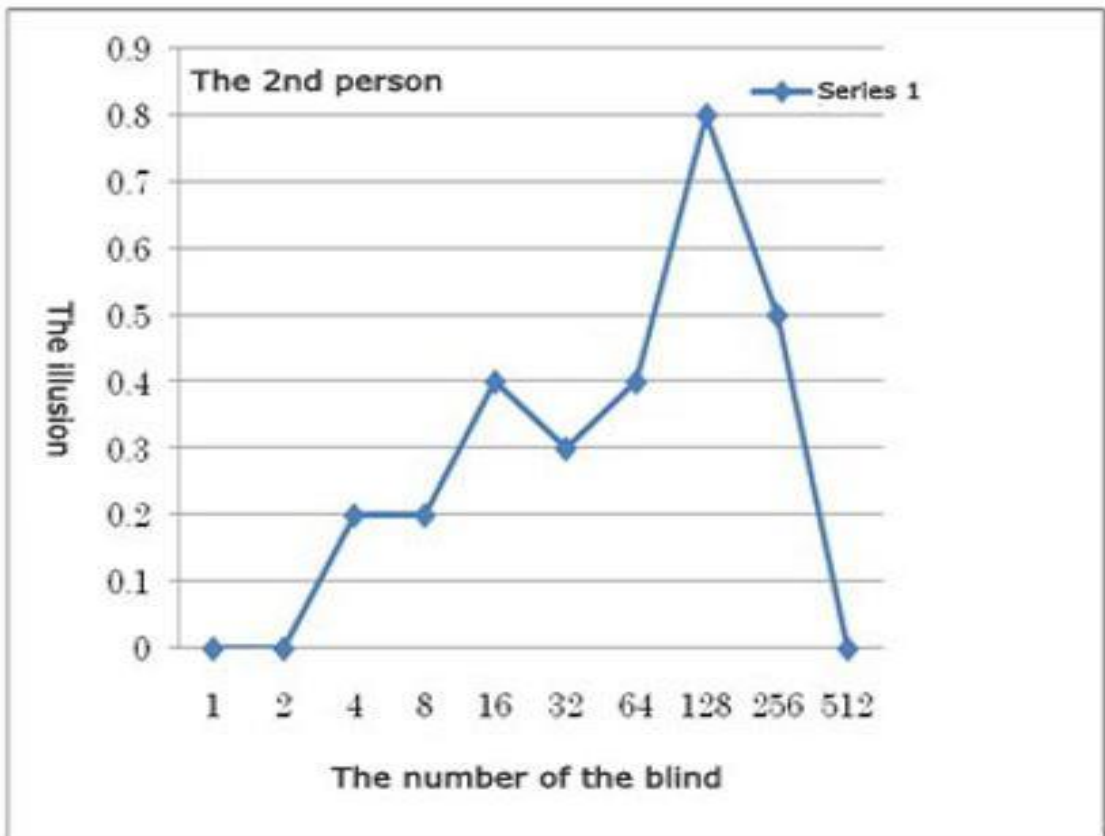
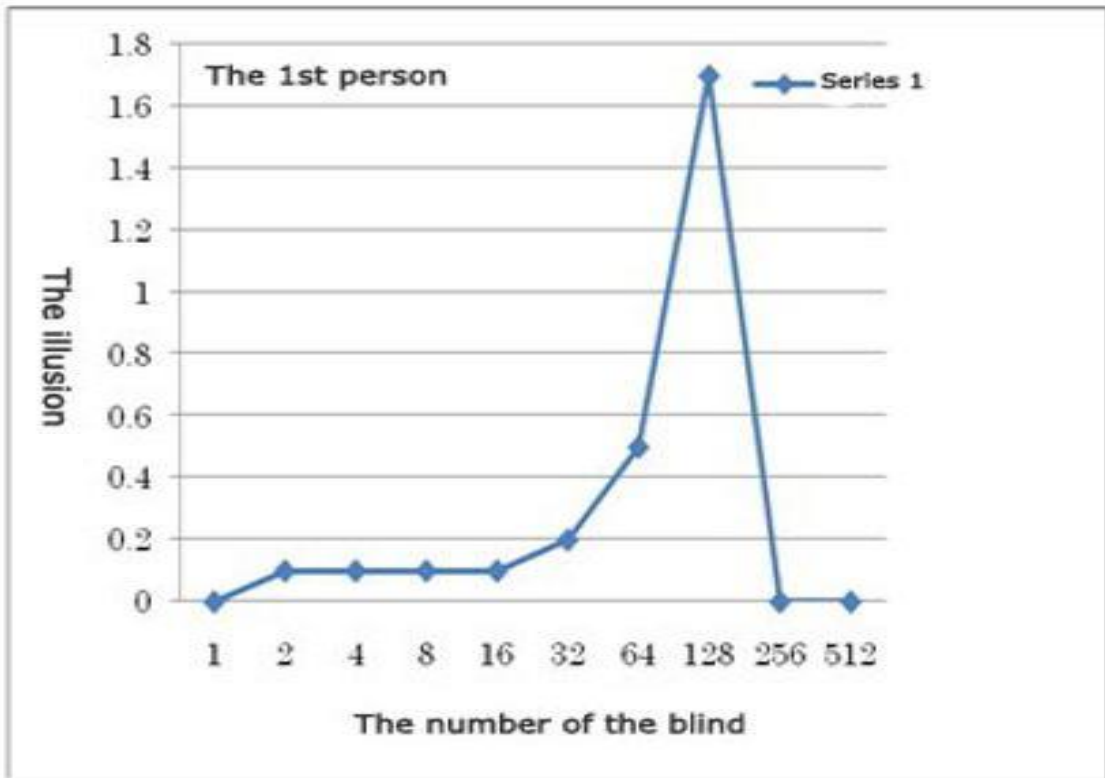


Figure 10.1 Personal data



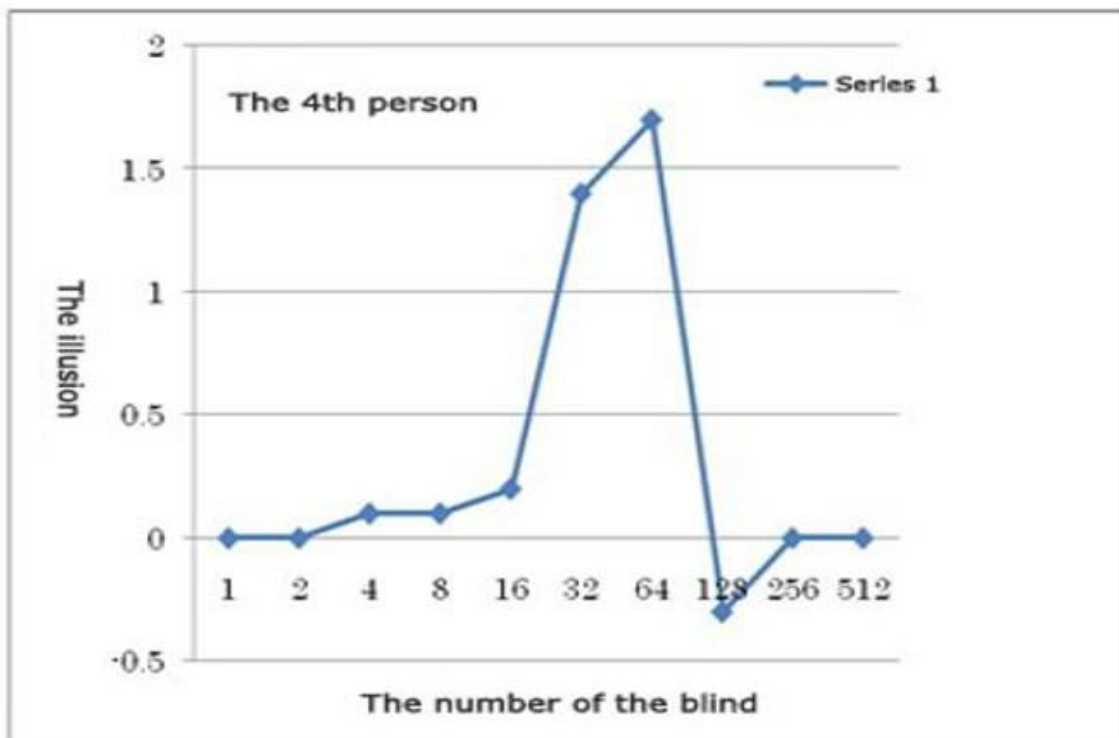
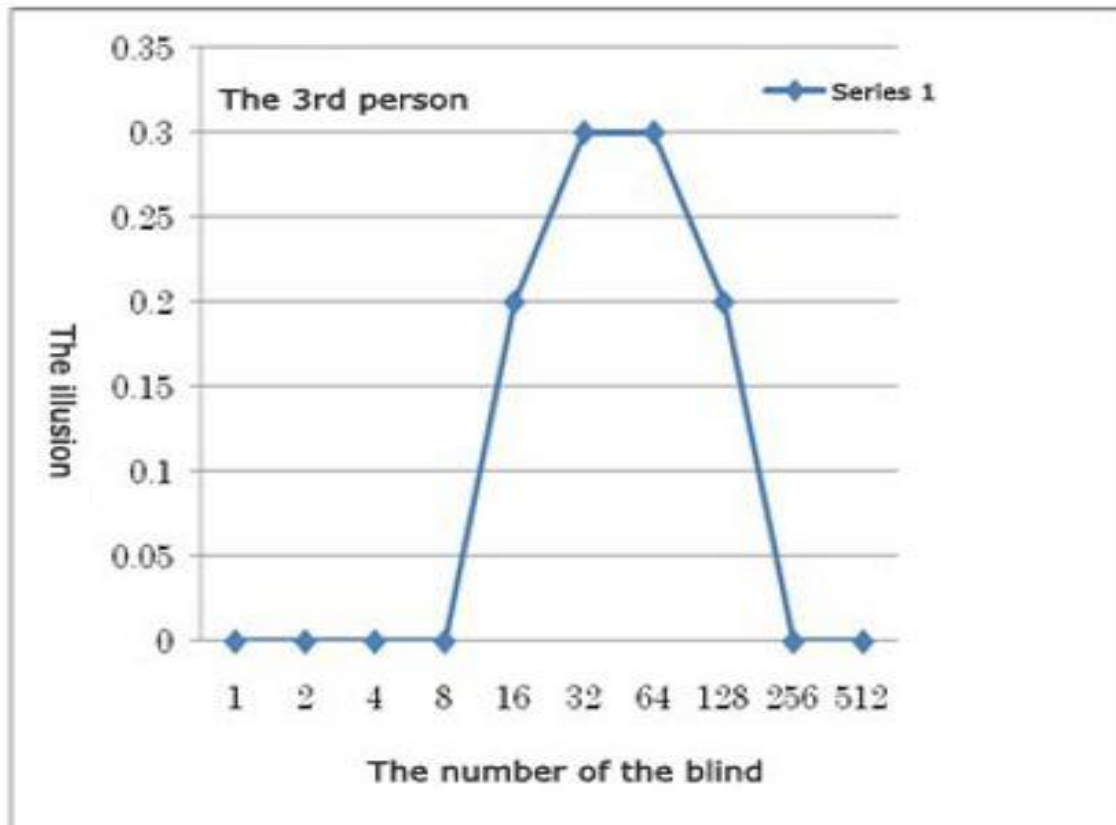
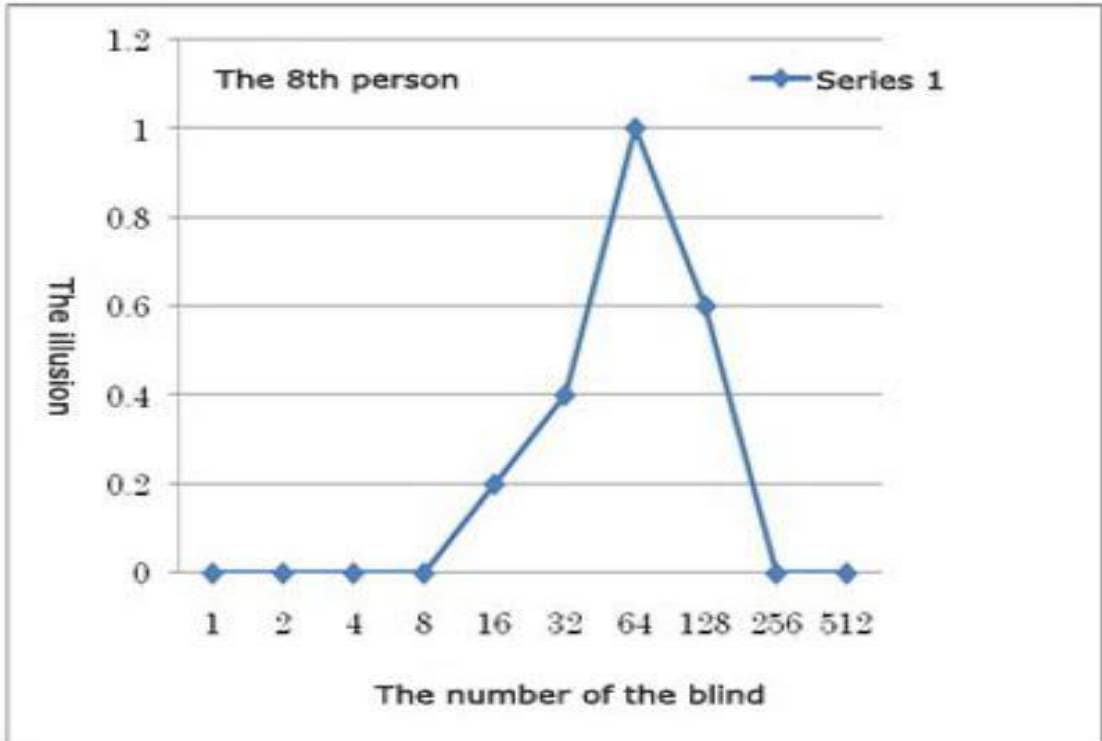
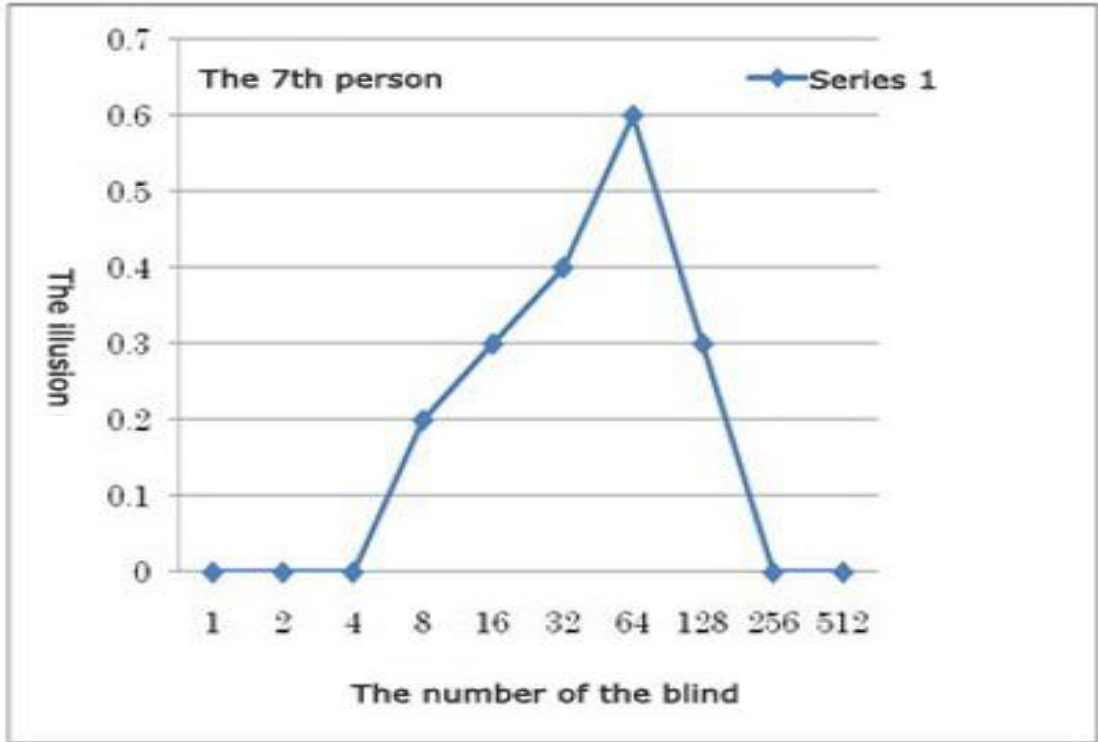


Figure 10.2 Personal data



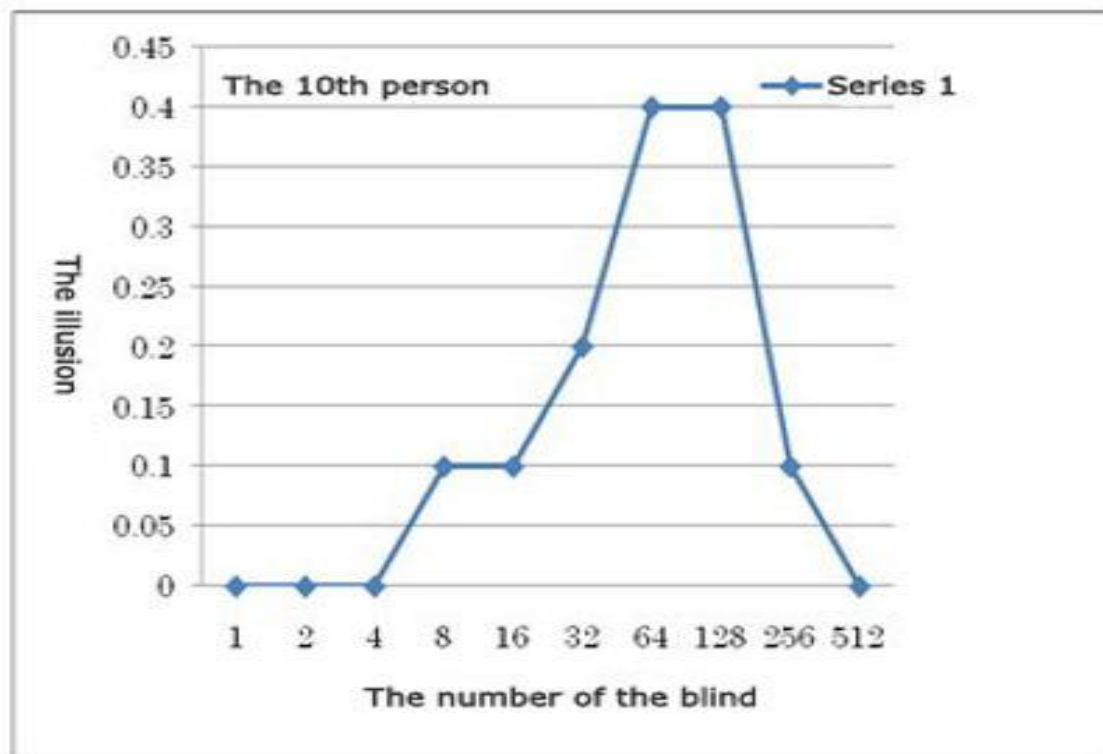
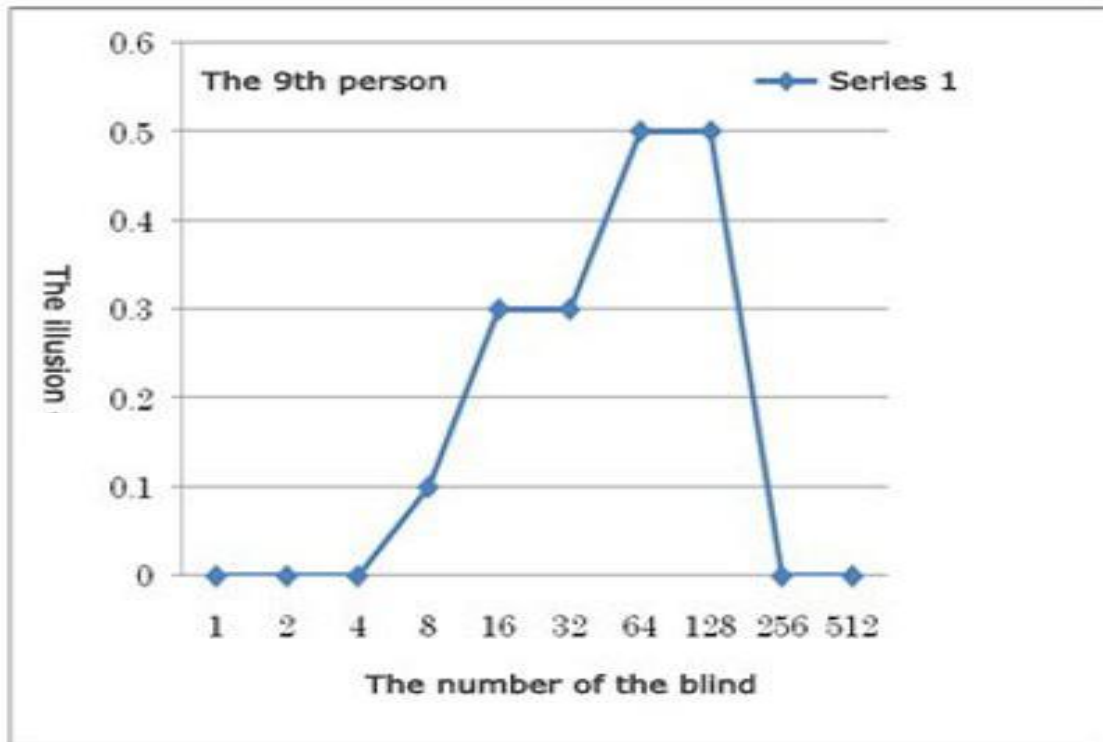


Figure 10.3 Personal data

Figure 10.1-3 is personal data of 10 subjects.

Each subject's data is different. There are, however, well according to the data of one variation of the optical illusion made sure that as predicted.

When the blinds are 64 and 128 is an illusion becomes maximum. People may feel up the illusion of 64 when the blinds are 10 people went six. And in the remaining four, two people did not change illusion of 64 and 128 pieces of felt to the same maximum. The last found that 2 is the biggest illusion of 128 pieces of felt.

Chapter 6 Experiment IV

Experiment III-64 when the illusion of is the biggest result was obtained. As a result, on the examined by silt further illusion of.

6.1 Equipment and environment

In experiment 1 the same experimental procedure.

Contributed to the 20-something college student 10 people, healthy subjects.

Using the monitor with the computing environment as well as experiment 1.

Experiments carried out experiments with similar equipment.

6.2 Stimulus

Subjects, provide two types of stimuli.

Stimulus 1 were a random dot pattern of white drawn on a 2D plane. This is a moving, the perception that it is snowing. Stimulus 1 diameter 1 deg, number of 2000 pieces, speed is 0.5 deg / s.

Stimulus 2 plus horizontal blinds model line; Stimulus 2 shall be adjustable between slit the blinds. Stimulus 2 height varies between the slit of 3.75 deg until from 0.25 deg.

Feel the show at the same time stimulating one and two exciting subjects and subjects equal each other's stimulus stimulated only operated. Slit adjusted to free stuff.

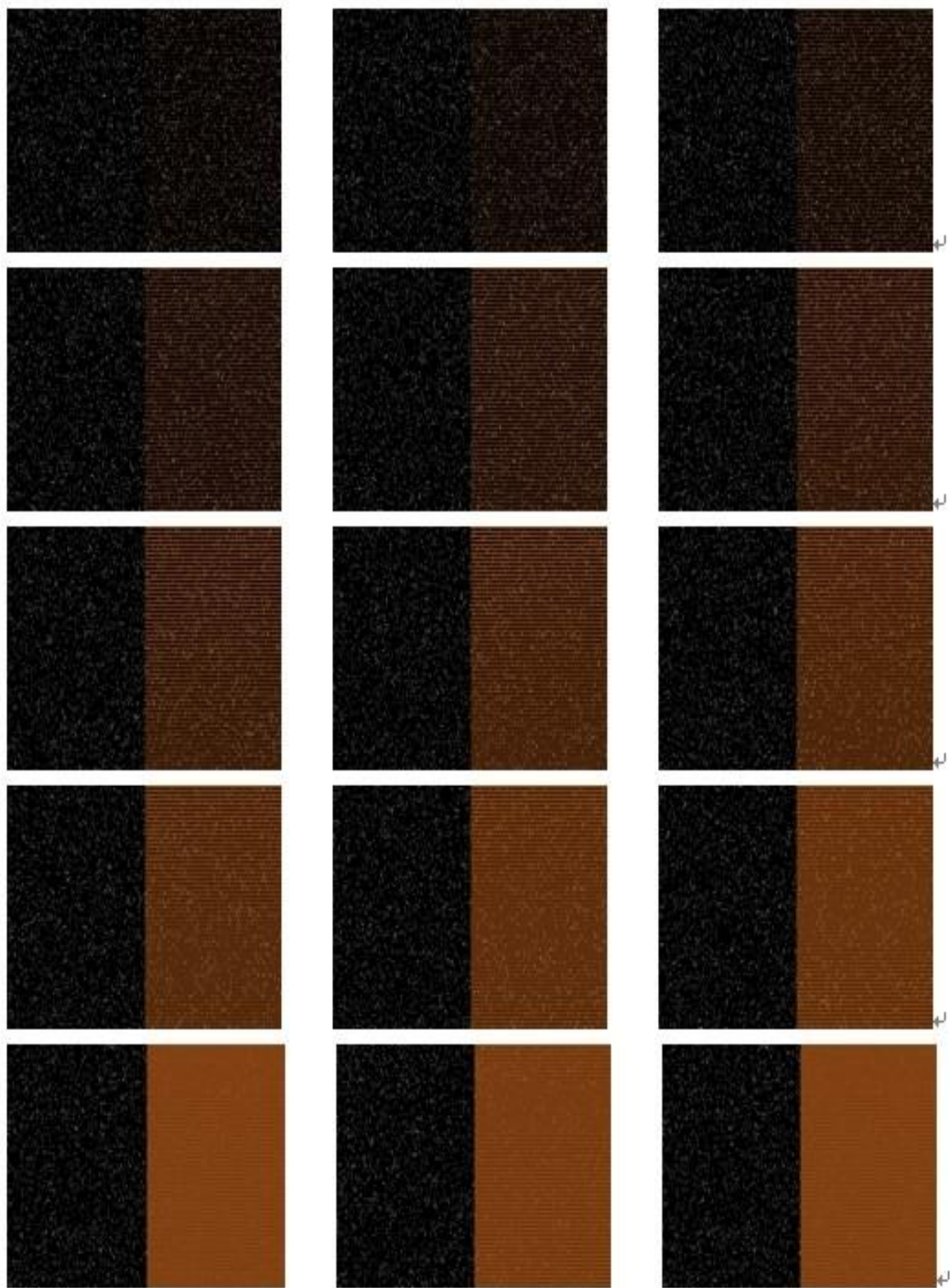


Figure 11. Silt

When it comes to 64 the number of blind as a result of the study, the biggest amount of illusion to be as a result on an experiment for the slit spacing. Figure 11 on 64-blind screen appears first. I made it because of the limitations of your monitor's display slit spacing is 15 pixels can be adjusted up to 1 pixel.

An experimental subject, one starts from the narrower parts hidden in a blind test. They determine whether the slit has 15 pixels on the screen of the first, at that time, an illusion. If the illusion, if not reduce the slit spacing 14 pixels. Also, make sure could feel the illusion. Street, continue reducing the slit. At the time was an illusion, stops the slit spacing. From that point, begin adjust the speed of the snow in the right screen. I think from the beginning left screen snow speed mismatch screen snow speed relative to get adjusted. If the stops working when I think both screen snow speed matches the speed variation.

Continue to experiment in this way, will steadily reduce slit. And to record changes in amount of spacing between each slit. If the slit spacing is 1 pixel, the experiment is over.

6.3 Test results

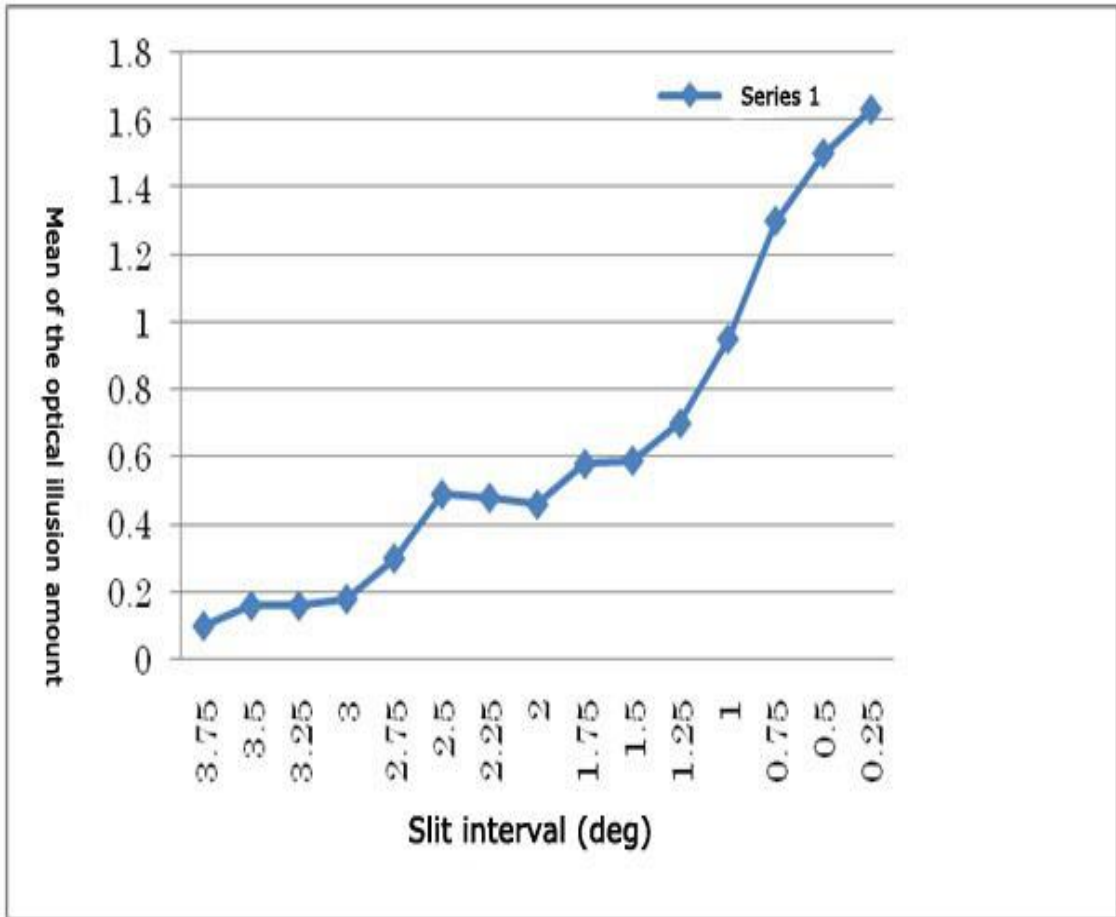
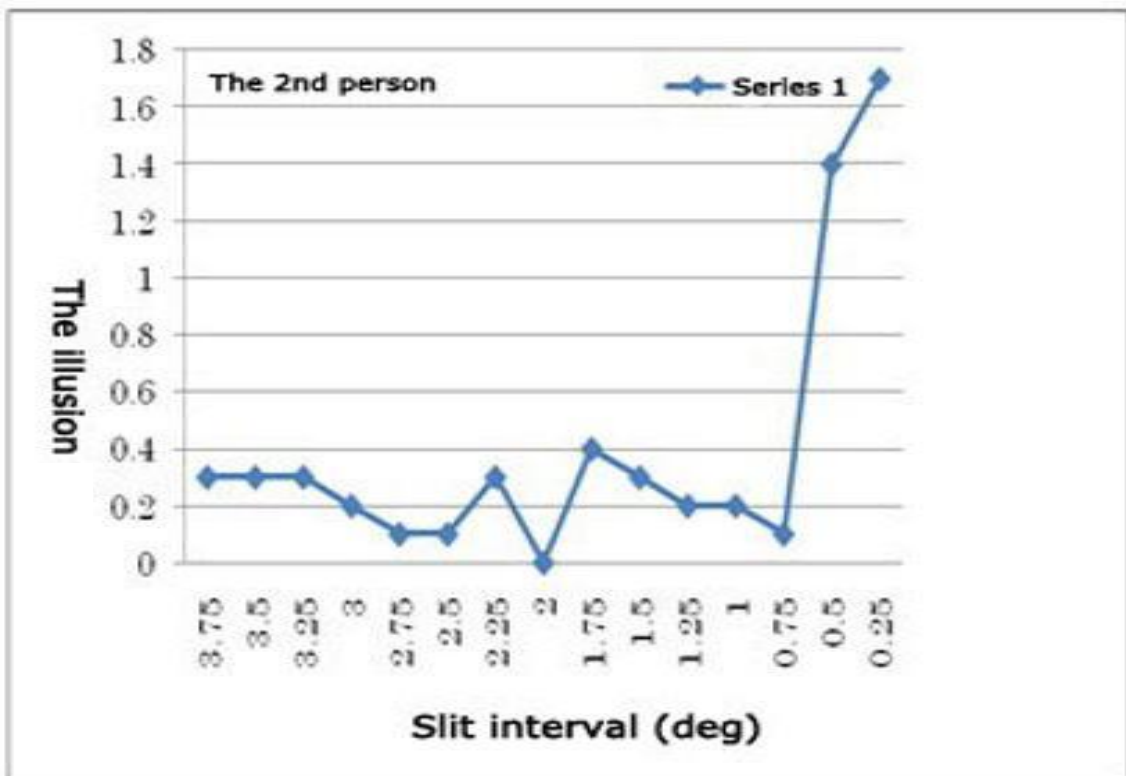
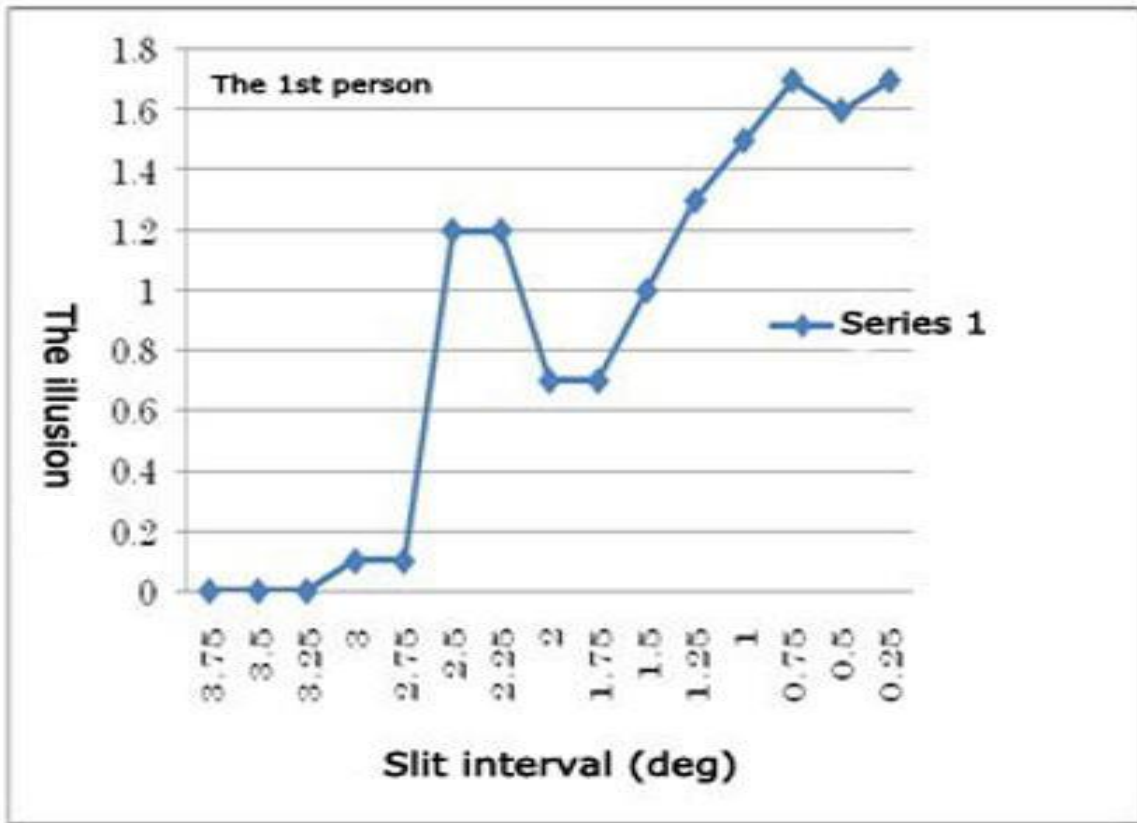
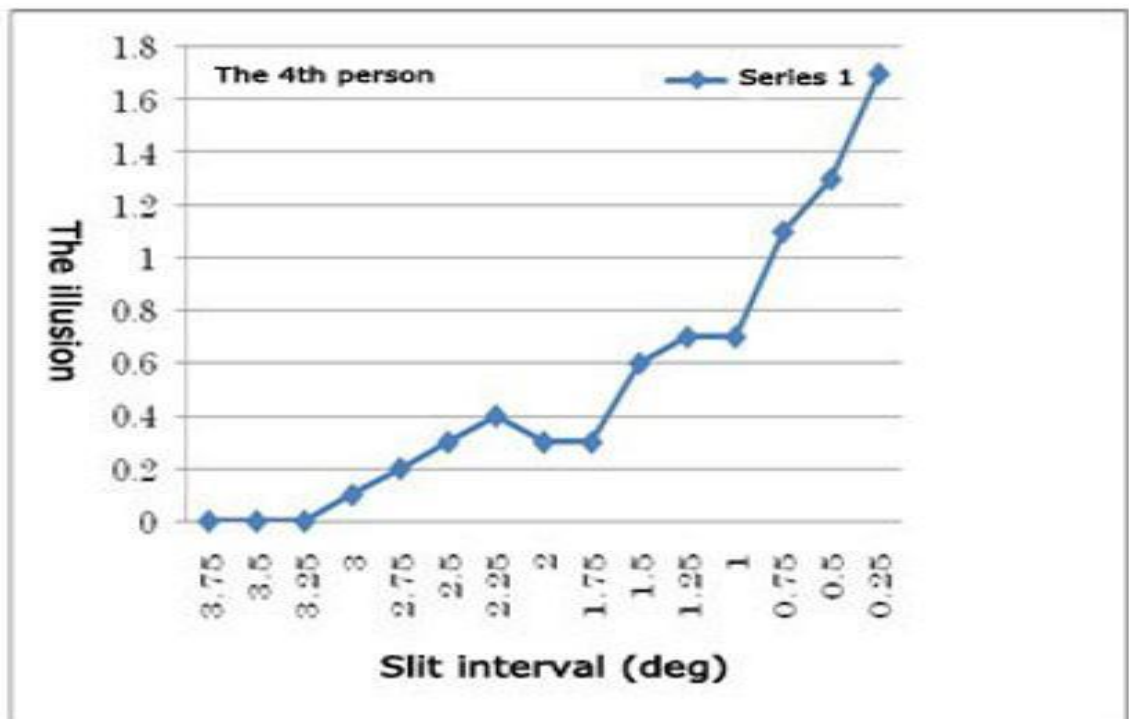
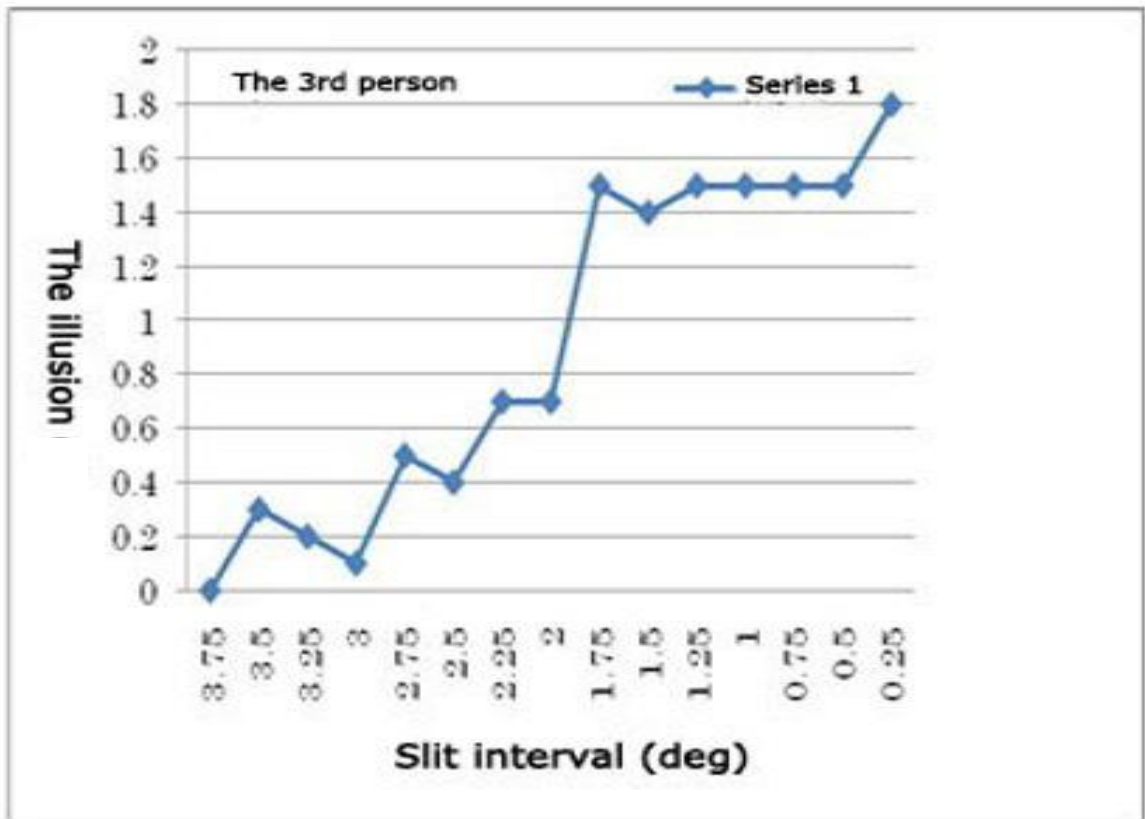


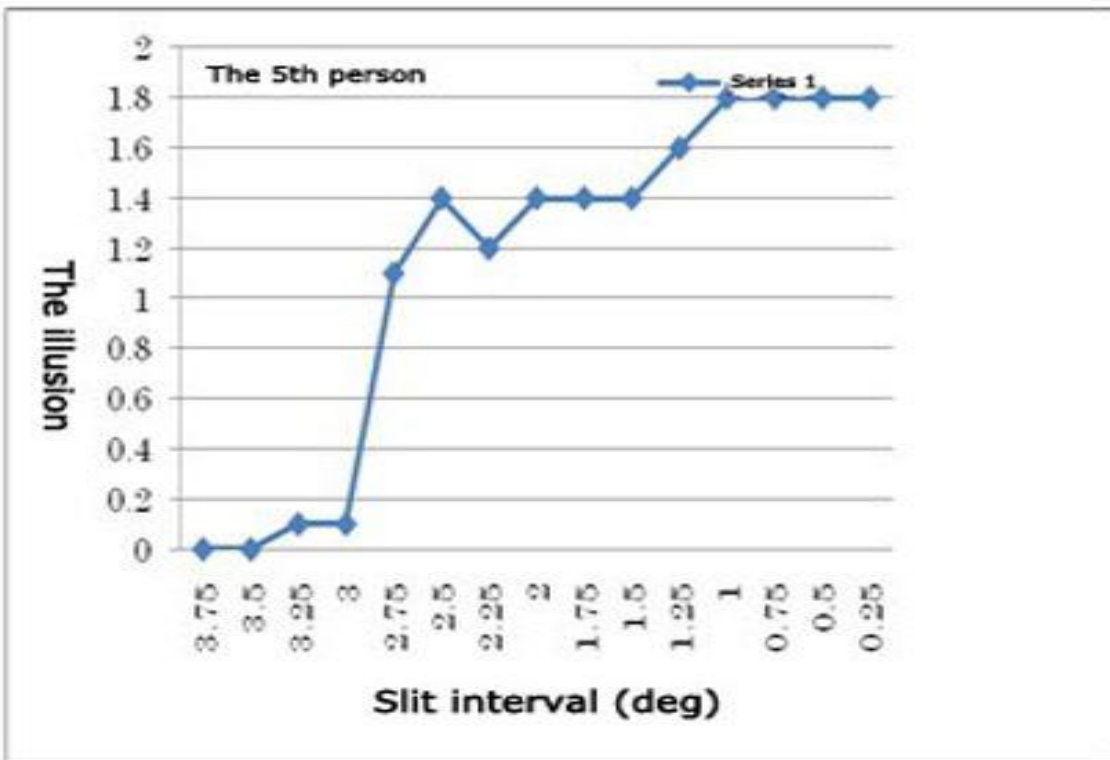
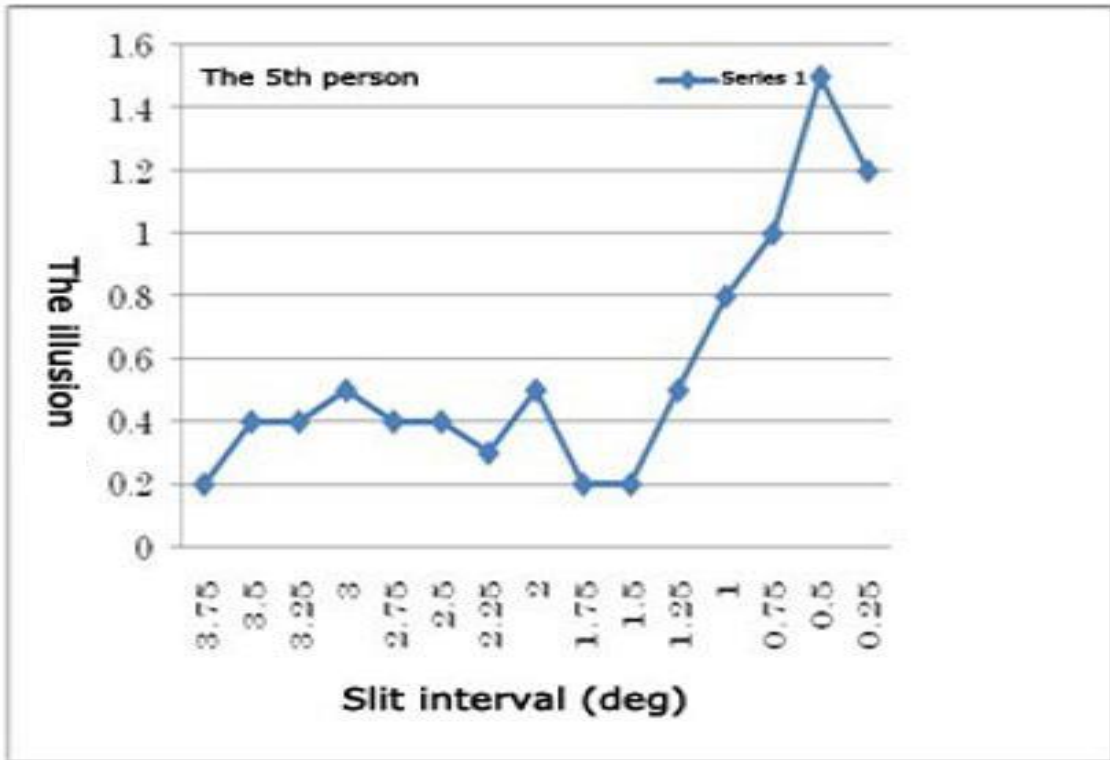
Figure 12. Average

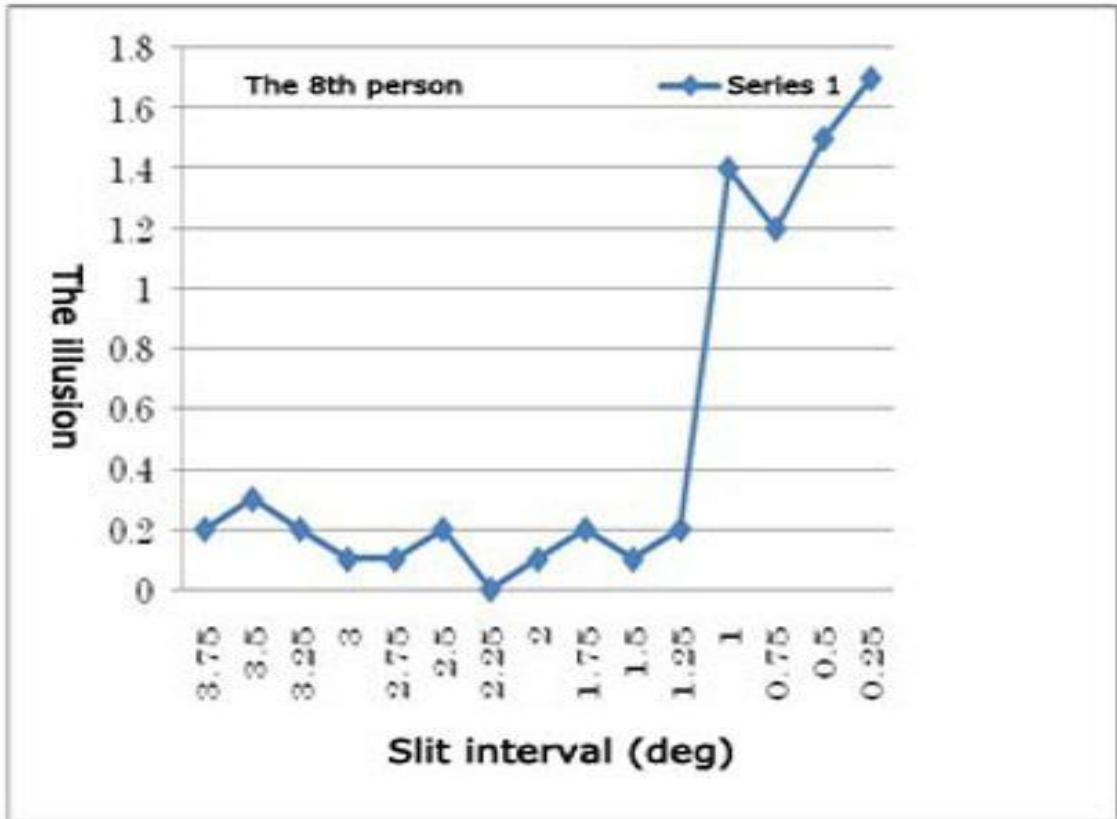
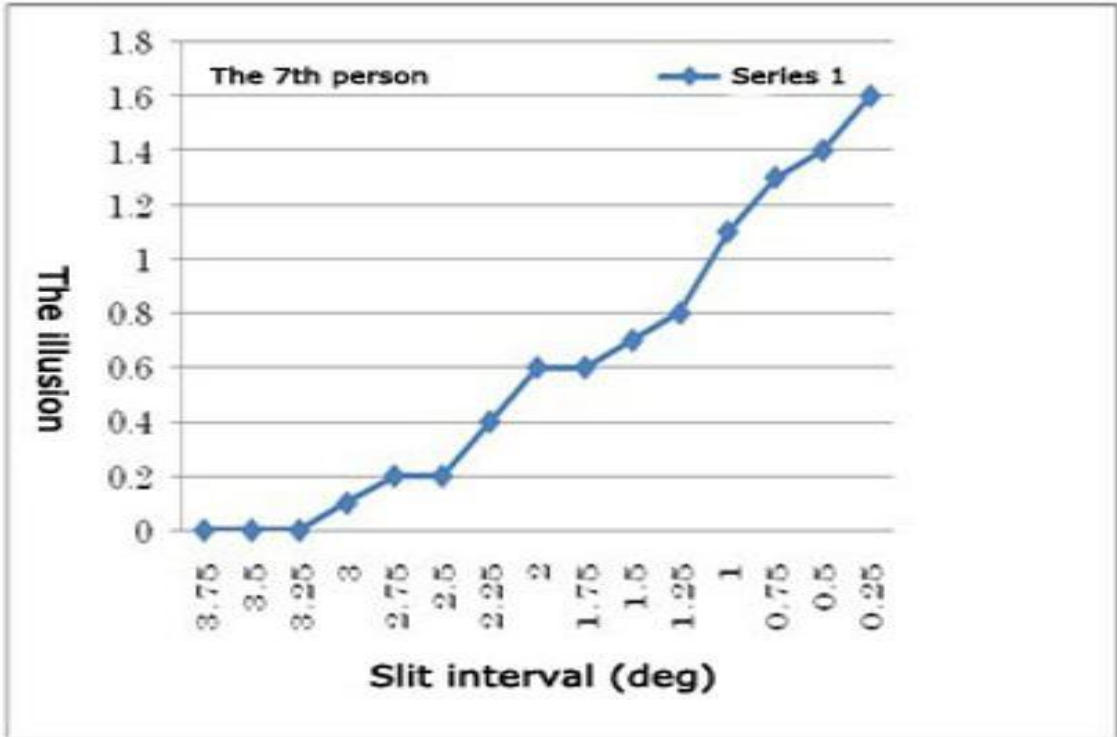
Figure 12 On the average data of the 10 subjects.

Were does not change, as displayed in Figure 12, reduce the silt up to 12 pixels from 15 pixels between the illusion of an illusion does not feel much. Consisting of 12 pixels to 10 pixels, and more slowly the illusion. However, discovered that the slit spacing reduced from 10 pixels to 8 pixels between the illusion of smaller. Found out that keeps reducing the slit spacing in pixels, or hide the blinds get bigger and increasing amount of illusion.









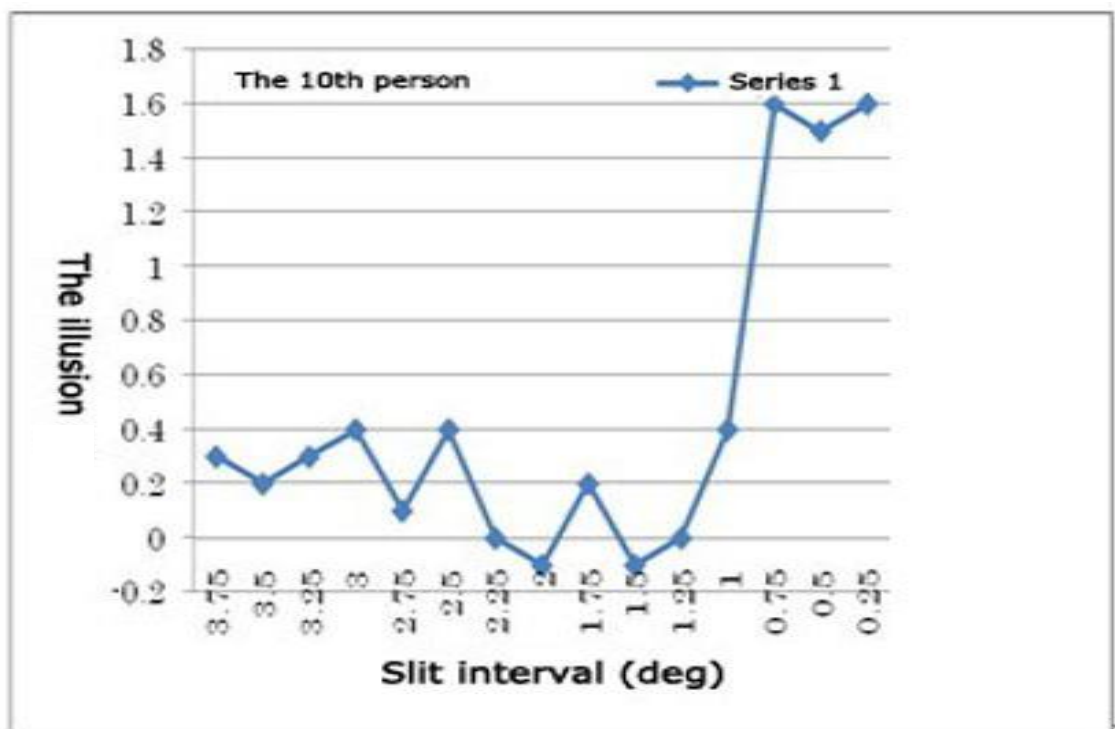
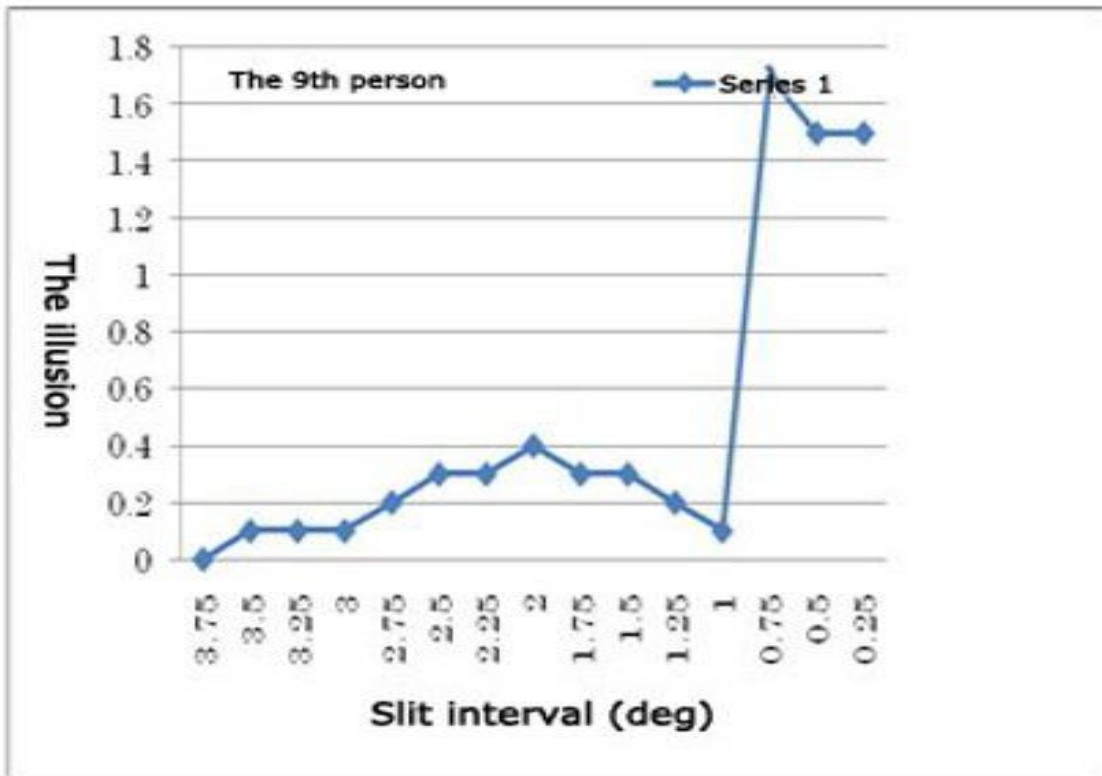


Figure 13. Personal data

Figure 13.is data of 10 subjects.

Each subject's data is different. Overall decreases the slit spacing and grow an illusion of results was confirmed.

However, it found that while personal data will look closely at the slit spacing 10-8 pixel reduces variation decreased data of five of 10 people.

Media technology that does not exist in the real world and virtual goods and optical illusion is said to show the information technology "phenomenon does not exist in the real world things seem" in this sense is not irrelevant. I think he caught the mistake in their broadest sense, diversion media technologies and content creation in society. For example, is the most likely cause of traffic jams on expressways in slowdowns in the accident also works but is known as the "SAG". Upgrade driver does not correctly recognize a kind of optical illusion speed bump, resulting in that is causing the jam. Believes would lead to congestion and eliminate the optical illusion of the driver, can drive a proper environment.

Experiments have found new optical illusion not seen up to now. And you determine the speed of its new optical illusion and reproduced on the computer. And falling snow at speed optical illusions lab computer monitor screen to show subject, on the screen on the left baseline, and set the velocity randomly on the screen of the right, left and the same subjects to speed and adjust the rate of snow fall right. Speed difference between left and right was quantitatively and accurately measure the speed illusion and illusion of speed. It by the speed illusion, is size of the illusion in the presence or absence of an optical illusion, optical illusion occurs, various conditions, such as you can see. Capable of supporting the study of perception and recognition by society through the mathematical modeling of the illusion of understanding and the results, with flexible and robust mathematical modeling and computational analysis that could build.

Chapter 7 Conclusion

The two experiments on blind illusion is based on the previous research, and we focus on the two factors: the falling speed of snowflakes and the width of blind strips, and test them separately.

From the experimental results, we can see that the illusion quantity will increase if the moving speed of the white spot becomes fast or the interval of the blind strips becomes narrow after removing abnormal data. Therefore we infer the two factors can both affect the illusion. We will study the overlap effect of them in the future study.

We use the method of limits in Experiment I on the study of falling speed, but find this method tend to affect the testers' following judgement. In order to prevent the tendency, we plan to use the constant method in the initial stage of the comparison stimuli. However, it will greatly increase the workload of all the experimenter. How to choose an experimental method is one of our future priorities. In addition, we also notice that the time spent by the testers in answering the questions is different. It is also necessary to consider the rule of reaction time and the burden of the experimenters.

In the future, more intelligent experimental models and more advanced analysis will be established. Artificial intelligence will be utilized to optimize or modify the measurement methods in order to reduce the workload of experimenters and the workload of post-processing data. For example, some optimization algorithms with adaptive adjustment strategy should be import into our experiments to shorten the number of cycles and increase more diverse experimental conditions.

Finally we noticed that in the nature snowflakes drop from the air not along a vertical line and each grain of snow is not the same size, which are worth discussing. In this experiment we note the difference between male and female on blind illusion and verify the difference of spatial perception of the brain between them[23], which is also the important issue of our future study.

Address of gratitude

I very sincerely thank my Professor Zheng Tang, and my Associate Professor Shangce Gao for their suggestions and support during the research. In the whole course of my research, I benefited from their advice and encouragement. It was a great pleasure to me for conducting this thesis under their supervision.

I also want to thank members of Tang Lab. Thanks for sharing the knowledge in the research field with me, giving me some good advices in my research and discussing with me about some theories on the field of blind illusion .

Of course, I am grateful to my parents. Without their love and patience, my research would never have come into existence.

Finally, I want to thank all the people who gave me kindly assistant and consideration during the period of my PhD.

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Appendix 1 Some examples of speed test records

date	time	kaisuu	hikaku_speed	hyojun_speed	result	houhou
2015 12 4	15:06:12	1	0.6	3	yes	up
2015 12 4	15:06:15	2	0.7	3	no	up
2015 12 4	15:06:19	3	0.8	3	no	up
2015 12 4	15:06:22	4	0.9	3	no	up
2015 12 4	15:06:25	5	1	3	no	up
2015 12 4	15:06:29	6	1.1	3	equal	up
2015 12 4	15:06:32	7	1.2	3	no	up
2015 12 4	15:06:35	8	1.3	3	no	up
2015 12 4	15:06:39	9	1.4	3	no	up
2015 12 4	15:06:44	10	1.5	3	yes	up
2015 12 4	15:06:49	11	1.6	3	equal	up
2015 12 4	15:06:53	12	1.7	3	equal	up
2015 12 4	15:06:58	13	1.8	3	equal	up
2015 12 4	15:07:02	14	1.9	3	equal	up
2015 12 4	15:07:06	15	2	3	yes	up
2015 12 4	15:07:10	16	2.1	3	yes	up
2015 12 4	15:07:14	17	2.2	3	yes	up

2015 12 4	15:07:18	18	4	4	yes	down
2015 12 4	15:07:22	19	3.9	4	yes	down
2015 12 4	15:07:26	20	3.8	4	yes	down
2015 12 4	15:07:30	21	3.7	4	yes	down
2015 12 4	15:07:35	22	3.6	4	yes	down
2015 12 4	15:07:39	23	3.5	4	yes	down
2015 12 4	15:07:43	24	3.4	4	yes	down
2015 12 4	15:07:46	25	3.3	4	yes	down
2015 12 4	15:07:50	26	3.2	4	yes	down
2015 12 4	15:07:53	27	3.1	4	yes	down
2015 12 4	15:07:56	28	3	4	yes	down
2015 12 4	15:08:00	29	2.9	4	yes	down
2015 12 4	15:08:03	30	2.8	4	yes	down
2015 12 4	15:08:07	31	2.7	4	yes	down
2015 12 4	15:08:11	32	2.6	4	yes	down
2015 12 4	15:08:15	33	2.5	4	yes	down
2015 12 4	15:08:19	34	2.4	4	no	down
2015 12 4	15:08:23	35	2.3	4	no	down

2015 12 4	15:08:27	36	2.2	4	yes	down
2015 12 4	15:08:31	37	2.1	4	yes	down
2015 12 4	15:08:35	38	2	4	equal	down
2015 12 4	15:08:39	39	1.9	4	no	down
2015 12 4	15:08:43	40	1.8	4	no	down
2015 12 4	15:08:47	41	1.7	4	no	down
2015 12 4	15:08:51	42	0.4	2.5	no	up
2015 12 4	15:08:54	43	0.5	2.5	no	up
2015 12 4	15:08:57	44	0.6	2.5	no	up
2015 12 4	15:08:59	45	0.7	2.5	no	up
2015 12 4	15:09:02	46	0.8	2.5	no	up
2015 12 4	15:09:05	47	0.9	2.5	no	up
2015 12 4	15:09:08	48	1	2.5	no	up
2015 12 4	15:09:11	49	1.1	2.5	no	up
2015 12 4	15:09:14	50	1.2	2.5	no	up
2015 12 4	15:09:18	51	1.3	2.5	no	up
2015 12 4	15:09:21	52	1.4	2.5	no	up
2015 12 4	15:09:25	53	1.5	2.5	no	up

2015 12 4	15:09:30	54	1.6	2.5	no	up
2015 12 4	15:09:34	55	1.7	2.5	no	up
2015 12 4	15:09:38	56	1.8	2.5	no	up
2015 12 4	15:09:42	57	1.9	2.5	no	up
2015 12 4	15:09:46	58	2	2.5	yes	up
2015 12 4	15:09:49	59	2.1	2.5	yes	up
2015 12 4	15:09:53	60	2.2	2.5	yes	up
2015 12 4	15:09:57	61	3.5	3.5	yes	down
2015 12 4	15:10:01	62	3.4	3.5	yes	down
2015 12 4	15:10:05	63	3.3	3.5	yes	down
2015 12 4	15:10:08	64	3.2	3.5	yes	down
2015 12 4	15:10:12	65	3.1	3.5	yes	down
2015 12 4	15:10:15	66	3	3.5	yes	down
2015 12 4	15:10:18	67	2.9	3.5	yes	down
2015 12 4	15:10:21	68	2.8	3.5	yes	down
2015 12 4	15:10:25	69	2.7	3.5	yes	down
2015 12 4	15:10:28	70	2.6	3.5	yes	down
2015 12 4	15:10:32	71	2.5	3.5	yes	down

2015 12 4	15:10:36	72	2.4	3.5	yes	down
2015 12 4	15:10:40	73	2.3	3.5	yes	down
2015 12 4	15:10:44	74	2.2	3.5	no	down
2015 12 4	15:10:48	75	2.1	3.5	yes	down
2015 12 4	15:10:52	76	2	3.5	yes	down
2015 12 4	15:10:56	77	1.9	3.5	yes	down
2015 12 4	15:11:01	78	1.8	3.5	equal	down
2015 12 4	15:11:05	79	1.7	3.5	equal	down
2015 12 4	15:11:10	80	1.6	3.5	equal	down
2015 12 4	15:11:14	81	1.5	3.5	equal	down
2015 12 4	15:11:19	82	1.4	3.5	equal	down
2015 12 4	15:11:23	83	1.3	3.5	equal	down
2015 12 4	15:11:27	84	1.2	3.5	no	down
2015 12 4	15:11:31	85	1.1	3.5	no	down
2015 12 4	15:11:34	86	1	3.5	no	down
2015 12 4	15:11:38	87	0.6	3	no	up
2015 12 4	15:11:41	88	0.7	3	no	up
2015 12 4	15:11:44	89	0.8	3	no	up

2015 12 4	15:11:47	90	0.9	3	no	up
2015 12 4	15:11:51	91	1	3	no	up
2015 12 4	15:11:54	92	1.1	3	yes	up
2015 12 4	15:11:58	93	1.2	3	equal	up
2015 12 4	15:12:02	94	1.3	3	no	up
2015 12 4	15:12:05	95	1.4	3	yes	up
2015 12 4	15:12:10	96	1.5	3	no	up
2015 12 4	15:12:14	97	1.6	3	yes	up
2015 12 4	15:12:18	98	1.7	3	no	up
2015 12 4	15:12:23	99	1.8	3	yes	up
2015 12 4	15:12:28	100	1.9	3	equal	up
2015 12 4	15:12:32	101	2	3	yes	up
2015 12 4	15:12:36	102	2.1	3	equal	up
2015 12 4	15:12:41	103	2.2	3	yes	up
2015 12 4	15:12:45	104	2.3	3	yes	up
2015 12 4	15:12:49	105	2.4	3	yes	up
2015 12 4	15:12:53	106	3.5	3.5	yes	down
2015 12 4	15:12:58	107	3.4	3.5	yes	down

2015 12 4	15:13:01	108	3.3	3.5	yes	down
2015 12 4	15:13:04	109	3.2	3.5	yes	down
2015 12 4	15:13:07	110	3.1	3.5	yes	down
2015 12 4	15:13:11	111	3	3.5	yes	down
2015 12 4	15:13:14	112	2.9	3.5	yes	down
2015 12 4	15:13:18	113	2.8	3.5	yes	down
2015 12 4	15:13:21	114	2.7	3.5	yes	down
2015 12 4	15:13:25	115	2.6	3.5	yes	down
2015 12 4	15:13:28	116	2.5	3.5	yes	down
2015 12 4	15:13:32	117	2.4	3.5	yes	down
2015 12 4	15:13:36	118	2.3	3.5	no	down
2015 12 4	15:13:40	119	2.2	3.5	no	down
2015 12 4	15:13:44	120	2.1	3.5	yes	down
2015 12 4	15:13:48	121	2	3.5	no	down
2015 12 4	15:13:52	122	1.9	3.5	yes	down
2015 12 4	15:13:57	123	1.8	3.5	equal	down
2015 12 4	15:14:02	124	1.7	3.5	no	down
2015 12 4	15:14:07	125	1.6	3.5	no	down

2015 12 4	15:14:12	126	1.5	3.5	equal	down
2015 12 4	15:14:16	127	1.4	3.5	equal	down
2015 12 4	15:14:19	128	1.3	3.5	equal	down
2015 12 4	15:14:23	129	1.2	3.5	no	down
2015 12 4	15:14:27	130	1.1	3.5	no	down
2015 12 4	15:14:30	131	1	3.5	no	down
2015 12 4	15:14:34	132	1	4	no	up
2015 12 4	15:14:38	133	1.1	4	no	up
2015 12 4	15:14:41	134	1.2	4	equal	up
2015 12 4	15:14:45	135	1.3	4	equal	up
2015 12 4	15:14:48	136	1.4	4	equal	up
2015 12 4	15:14:53	137	1.5	4	no	up
2015 12 4	15:14:58	138	1.6	4	no	up
2015 12 4	15:15:02	139	1.7	4	equal	up
2015 12 4	15:15:07	140	1.8	4	yes	up
2015 12 4	15:15:12	141	1.9	4	yes	up
2015 12 4	15:15:16	142	2	4	yes	up
2015 12 4	15:15:19	143	3	3	yes	down

2015 12 4	15:15:23	144	2.9	3	yes	down
2015 12 4	15:15:26	145	2.8	3	yes	down
2015 12 4	15:15:30	146	2.7	3	yes	down
2015 12 4	15:15:34	147	2.6	3	yes	down
2015 12 4	15:15:37	148	2.5	3	yes	down
2015 12 4	15:15:41	149	2.4	3	yes	down
2015 12 4	15:15:45	150	2.3	3	yes	down
2015 12 4	15:15:50	151	2.2	3	no	down
2015 12 4	15:15:54	152	2.1	3	no	down
2015 12 4	15:15:59	153	2	3	equal	down
2015 12 4	15:16:03	154	1.9	3	equal	down
2015 12 4	15:16:07	155	1.8	3	equal	down
2015 12 4	15:16:12	156	1.7	3	equal	down
2015 12 4	15:16:16	157	1.6	3	equal	down
2015 12 4	15:16:21	158	1.5	3	equal	down
2015 12 4	15:16:26	159	1.4	3	no	down
2015 12 4	15:16:30	160	1.3	3	no	down
2015 12 4	15:16:34	161	1.2	3	equal	down

2015 12 4	15:16:38	162	1.1	3	equal	down
2015 12 4	15:16:42	163	1	3	equal	down
2015 12 4	15:16:45	164	0.9	3	no	down
2015 12 4	15:16:48	165	0.8	3	no	down
2015 12 4	15:16:51	166	0.7	3	no	down
2015 12 4	15:16:55	167	0.2	2	no	up
2015 12 4	15:16:59	168	0.3	2	no	up
2015 12 4	15:17:02	169	0.4	2	no	up
2015 12 4	15:17:06	170	0.5	2	no	up
2015 12 4	15:17:08	171	0.6	2	no	up
2015 12 4	15:17:12	172	0.7	2	no	up
2015 12 4	15:17:15	173	0.8	2	no	up
2015 12 4	15:17:18	174	0.9	2	no	up
2015 12 4	15:17:22	175	1	2	equal	up
2015 12 4	15:17:25	176	1.1	2	equal	up
2015 12 4	15:17:29	177	1.2	2	equal	up
2015 12 4	15:17:32	178	1.3	2	equal	up
2015 12 4	15:17:36	179	1.4	2	yes	up

2015 12 4	15:17:41	180	1.5	2	yes	up
2015 12 4	15:17:46	181	1.6	2	yes	up
2015 12 4	15:17:50	182	3	3	yes	down
2015 12 4	15:17:53	183	2.9	3	yes	down
2015 12 4	15:17:57	184	2.8	3	yes	down
2015 12 4	15:18:00	185	2.7	3	yes	down
2015 12 4	15:18:04	186	2.6	3	yes	down
2015 12 4	15:18:08	187	2.5	3	yes	down
2015 12 4	15:18:11	188	2.4	3	yes	down
2015 12 4	15:18:15	189	2.3	3	yes	down
2015 12 4	15:18:20	190	2.2	3	yes	down
2015 12 4	15:18:24	191	2.1	3	yes	down
2015 12 4	15:18:29	192	2	3	equal	down
2015 12 4	15:18:33	193	1.9	3	yes	down
2015 12 4	15:18:38	194	1.8	3	equal	down
2015 12 4	15:18:43	195	1.7	3	equal	down
2015 12 4	15:18:47	196	1.6	3	yes	down
2015 12 4	15:18:52	197	1.5	3	equal	down

2015 12 4	15:18:56	198	1.4	3	yes	down
2015 12 4	15:19:00	199	1.3	3	yes	down
2015 12 4	15:19:04	200	1.2	3	no	down
2015 12 4	15:19:08	201	1.1	3	no	down
2015 12 4	15:19:12	202	1	3	equal	down
2015 12 4	15:19:15	203	0.9	3	equal	down
2015 12 4	15:19:19	204	0.8	3	equal	down
2015 12 4	15:19:22	205	0.7	3	equal	down
2015 12 4	15:19:25	206	0.6	3	no	down
2015 12 4	15:19:29	207	0.5	3	no	down
2015 12 4	15:19:33	208	0.4	3	no	down
2015 12 4	15:19:36	209	0.8	3.5	no	up
2015 12 4	15:19:40	210	0.9	3.5	equal	up
2015 12 4	15:19:44	211	1	3.5	equal	up
2015 12 4	15:19:47	212	1.1	3.5	equal	up
2015 12 4	15:19:51	213	1.2	3.5	equal	up
2015 12 4	15:19:55	214	1.3	3.5	yes	up
2015 12 4	15:19:59	215	1.4	3.5	equal	up

2015 12 4	15:20:04	216	1.5	3.5	no	up
2015 12 4	15:20:08	217	1.6	3.5	equal	up
2015 12 4	15:20:13	218	1.7	3.5	equal	up
2015 12 4	15:20:17	219	1.8	3.5	yes	up
2015 12 4	15:20:22	220	1.9	3.5	yes	up
2015 12 4	15:20:26	221	2	3.5	equal	up
2015 12 4	15:20:31	222	2.1	3.5	yes	up
2015 12 4	15:20:35	223	2.2	3.5	yes	up
2015 12 4	15:20:39	224	2.3	3.5	yes	up
2015 12 4	15:20:44	225	3.5	3.5	yes	down
2015 12 4	15:20:49	226	3.4	3.5	yes	down
2015 12 4	15:20:52	227	3.3	3.5	yes	down
2015 12 4	15:20:56	228	3.2	3.5	yes	down
2015 12 4	15:20:59	229	3.1	3.5	yes	down
2015 12 4	15:21:03	230	3	3.5	yes	down
2015 12 4	15:21:07	231	2.9	3.5	yes	down
2015 12 4	15:21:11	232	2.8	3.5	yes	down
2015 12 4	15:21:15	233	2.7	3.5	yes	down

2015 12 4	15:21:19	234	2.6	3.5	yes	down
2015 12 4	15:21:22	235	2.5	3.5	yes	down
2015 12 4	15:21:26	236	2.4	3.5	yes	down
2015 12 4	15:21:30	237	2.3	3.5	yes	down
2015 12 4	15:21:35	238	2.2	3.5	equal	down
2015 12 4	15:21:39	239	2.1	3.5	yes	down
2015 12 4	15:21:44	240	2	3.5	yes	down
2015 12 4	15:21:48	241	1.9	3.5	yes	down
2015 12 4	15:21:53	242	1.8	3.5	yes	down
2015 12 4	15:21:58	243	1.7	3.5	yes	down
2015 12 4	15:22:03	244	1.6	3.5	no	down
2015 12 4	15:22:08	245	1.5	3.5	no	down
2015 12 4	15:22:12	246	1.4	3.5	no	down
2015 12 4	15:22:15	247	0.8	3.5	no	up
2015 12 4	15:22:19	248	0.9	3.5	no	up
2015 12 4	15:22:23	249	1	3.5	no	up
2015 12 4	15:22:27	250	1.1	3.5	no	up
2015 12 4	15:22:31	251	1.2	3.5	equal	up

2015 12 4	15:22:34	252	1.3	3.5	equal	up
2015 12 4	15:22:38	253	1.4	3.5	equal	up
2015 12 4	15:22:43	254	1.5	3.5	equal	up
2015 12 4	15:22:48	255	1.6	3.5	yes	up
2015 12 4	15:22:53	256	1.7	3.5	yes	up
2015 12 4	15:22:58	257	1.8	3.5	yes	up
2015 12 4	15:23:02	258	2	2	yes	down
2015 12 4	15:23:06	259	1.9	2	yes	down
2015 12 4	15:23:10	260	1.8	2	yes	down
2015 12 4	15:23:15	261	1.7	2	yes	down
2015 12 4	15:23:20	262	1.6	2	yes	down
2015 12 4	15:23:25	263	1.5	2	no	down
2015 12 4	15:23:32	264	1.4	2	equal	down
2015 12 4	15:23:36	265	1.3	2	equal	down
2015 12 4	15:23:40	266	1.2	2	equal	down
2015 12 4	15:23:44	267	1.1	2	equal	down
2015 12 4	15:23:48	268	1	2	equal	down
2015 12 4	15:23:52	269	0.9	2	yes	down

2015 12 4	15:23:56	270	0.8	2	yes	down
2015 12 4	15:23:59	271	0.7	2	yes	down
2015 12 4	15:24:03	272	0.6	2	no	down
2015 12 4	15:24:06	273	0.5	2	no	down
2015 12 4	15:24:11	274	0.4	2	no	down
2015 12 4	15:24:16	275	1	4	no	up
2015 12 4	15:24:19	276	1.1	4	equal	up
2015 12 4	15:24:24	277	1.2	4	equal	up
2015 12 4	15:24:28	278	1.3	4	yes	up
2015 12 4	15:24:32	279	1.4	4	equal	up
2015 12 4	15:24:37	280	1.5	4	yes	up
2015 12 4	15:24:42	281	1.6	4	equal	up
2015 12 4	15:24:47	282	1.7	4	equal	up
2015 12 4	15:24:53	283	1.8	4	equal	up
2015 12 4	15:24:58	284	1.9	4	yes	up
2015 12 4	15:25:02	285	2	4	yes	up
2015 12 4	15:25:06	286	2.1	4	yes	up
2015 12 4	15:25:10	287	3	3	yes	down

2015 12 4	15:25:13	288	2.9	3	yes	down
2015 12 4	15:25:17	289	2.8	3	yes	down
2015 12 4	15:25:20	290	2.7	3	yes	down
2015 12 4	15:25:24	291	2.6	3	yes	down
2015 12 4	15:25:28	292	2.5	3	yes	down
2015 12 4	15:25:31	293	2.4	3	yes	down
2015 12 4	15:25:36	294	2.3	3	yes	down
2015 12 4	15:25:40	295	2.2	3	yes	down
2015 12 4	15:25:46	296	2.1	3	yes	down
2015 12 4	15:25:51	297	2	3	yes	down
2015 12 4	15:25:56	298	1.9	3	yes	down
2015 12 4	15:26:00	299	1.8	3	yes	down
2015 12 4	15:26:05	300	1.7	3	no	down
2015 12 4	15:26:10	301	1.6	3	yes	down
2015 12 4	15:26:15	302	1.5	3	equal	down
2015 12 4	15:26:19	303	1.4	3	yes	down
2015 12 4	15:26:23	304	1.3	3	yes	down
2015 12 4	15:26:27	305	1.2	3	equal	down

2015 12 4	15:26:31	306	1.1	3	equal	down
2015 12 4	15:26:36	307	1	3	no	down
2015 12 4	15:26:39	308	0.9	3	no	down
2015 12 4	15:26:42	309	0.8	3	no	down
2015 12 4	15:26:46	310	0.6	3	no	up
2015 12 4	15:26:49	311	0.7	3	no	up
2015 12 4	15:26:52	312	0.8	3	no	up
2015 12 4	15:26:56	313	0.9	3	no	up
2015 12 4	15:27:00	314	1	3	equal	up
2015 12 4	15:27:03	315	1.1	3	no	up
2015 12 4	15:27:09	316	1.2	3	no	up
2015 12 4	15:27:13	317	1.3	3	yes	up
2015 12 4	15:27:21	318	1.4	3	yes	up
2015 12 4	15:27:26	319	1.5	3	yes	up
2015 12 4	15:27:30	320	3.5	3.5	yes	down
2015 12 4	15:27:35	321	3.4	3.5	yes	down
2015 12 4	15:27:42	322	3.3	3.5	yes	down
2015 12 4	15:27:45	323	3.2	3.5	yes	down

2015 12 4	15:27:48	324	3.1	3.5	yes	down
2015 12 4	15:27:52	325	3	3.5	yes	down
2015 12 4	15:27:57	326	2.9	3.5	yes	down
2015 12 4	15:28:01	327	2.8	3.5	yes	down
2015 12 4	15:28:05	328	2.7	3.5	yes	down
2015 12 4	15:28:11	329	2.6	3.5	equal	down
2015 12 4	15:28:15	330	2.5	3.5	yes	down
2015 12 4	15:28:19	331	2.4	3.5	yes	down
2015 12 4	15:28:22	332	2.3	3.5	yes	down
2015 12 4	15:28:26	333	2.2	3.5	yes	down
2015 12 4	15:28:30	334	2.1	3.5	yes	down
2015 12 4	15:28:38	335	2	3.5	yes	down
2015 12 4	15:28:43	336	1.9	3.5	equal	down
2015 12 4	15:28:48	337	1.8	3.5	equal	down
2015 12 4	15:28:52	338	1.7	3.5	equal	down
2015 12 4	15:28:57	339	1.6	3.5	equal	down
2015 12 4	15:29:02	340	1.5	3.5	equal	down
2015 12 4	15:29:08	341	1.4	3.5	yes	down

2015 12 4	15:29:11	342	1.3	3.5	yes	down
2015 12 4	15:29:18	343	1.2	3.5	no	down
2015 12 4	15:29:21	344	1.1	3.5	no	down
2015 12 4	15:29:25	345	1	3.5	no	down
2015 12 4	15:29:28	346	0.8	3.5	no	up
2015 12 4	15:29:34	347	0.9	3.5	no	up
2015 12 4	15:29:40	348	1	3.5	no	up
2015 12 4	15:29:46	349	1.1	3.5	no	up
2015 12 4	15:29:50	350	1.2	3.5	no	up
2015 12 4	15:29:55	351	1.3	3.5	no	up
2015 12 4	15:29:58	352	1.4	3.5	equal	up
2015 12 4	15:30:03	353	1.5	3.5	equal	up
2015 12 4	15:30:08	354	1.6	3.5	no	up
2015 12 4	15:30:12	355	1.7	3.5	equal	up
2015 12 4	15:30:20	356	1.8	3.5	no	up
2015 12 4	15:30:27	357	1.9	3.5	equal	up
2015 12 4	15:30:35	358	2	3.5	yes	up
2015 12 4	15:30:39	359	2.1	3.5	yes	up

2015 12 4	15:30:43	360	2.2	3.5	yes	up
2015 12 4	15:30:47	361	2.5	2.5	yes	down
2015 12 4	15:30:51	362	2.4	2.5	yes	down
2015 12 4	15:30:54	363	2.3	2.5	yes	down
2015 12 4	15:30:58	364	2.2	2.5	yes	down
2015 12 4	15:31:02	365	2.1	2.5	yes	down
2015 12 4	15:31:09	366	2	2.5	yes	down
2015 12 4	15:31:13	367	1.9	2.5	yes	down
2015 12 4	15:31:20	368	1.8	2.5	yes	down
2015 12 4	15:31:26	369	1.7	2.5	equal	down
2015 12 4	15:31:34	370	1.6	2.5	equal	down
2015 12 4	15:31:39	371	1.5	2.5	equal	down
2015 12 4	15:31:46	372	1.4	2.5	equal	down
2015 12 4	15:31:50	373	1.3	2.5	yes	down
2015 12 4	15:31:59	374	1.2	2.5	no	down
2015 12 4	15:32:03	375	1.1	2.5	yes	down
2015 12 4	15:32:08	376	1	2.5	no	down
2015 12 4	15:32:11	377	0.9	2.5	no	down

2015 12 4	15:32:17	378	0.8	2.5	no	down
2015 12 4	15:32:22	379	1	4	no	up
2015 12 4	15:32:27	380	1.1	4	yes	up
2015 12 4	15:32:34	381	1.2	4	no	up
2015 12 4	15:32:38	382	1.3	4	equal	up
2015 12 4	15:32:42	383	1.4	4	equal	up
2015 12 4	15:32:47	384	1.5	4	yes	up
2015 12 4	15:32:51	385	1.6	4	equal	up
2015 12 4	15:32:56	386	1.7	4	equal	up
2015 12 4	15:33:00	387	1.8	4	equal	up
2015 12 4	15:33:06	388	1.9	4	yes	up
2015 12 4	15:33:10	389	2	4	yes	up
2015 12 4	15:33:15	390	2.1	4	yes	up
2015 12 4	15:33:17	391	3	3	yes	down

Appendix 2 Some examples of interval test records

date	time	total	x	slit	left_star	right_star	result
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					t	t	
2015 12 14	16:22:0 9	1	104	5.3	223	384	eq_slo w
2015 12 14	16:22:2 5	2	80	4.1	6	482	eq_slo w
2015 12 14	16:22:3 3	3	16	0.9	405	331	speedy
2015 12 14	16:22:4 3	4	32	1.7	218	352	speedy
2015 12 14	16:22:5 1	5	40	2.1	391	321	eq_slo w
2015 12 14	16:23:0 3	6	40	2.1	73	353	speedy
2015 12 14	16:23:1 1	7	48	2.5	84	401	eq_slo w
2015 12 14	16:23:1 8	8	0	0.1	296	476	speedy
2015 12 14	16:23:2 9	9	16	0.9	370	287	eq_slo w
2015 12 14	16:23:4 5	10	96	4.9	397	209	eq_slo w
2015 12 14	16:23:5 2	11	88	4.5	322	465	eq_slo w
2015 12 14	16:23:5 8	12	96	4.9	348	358	eq_slo w
2015 12 14	16:24:0 3	13	32	1.7	351	393	eq_slo w
2015 12 14	16:24:1 2	14	16	0.9	366	310	eq_slo w
2015 12 14	16:24:2 3	15	56	2.9	276	186	eq_slo w
2015 12 14	16:24:3 1	16	40	2.1	285	457	speedy
2015 12 14	16:24:4 2	17	32	1.7	347	319	speedy

2015 12 14	16:24:5 0	18	56	2.9	400	152	eq_slo w
2015 12 14	16:24:5 5	19	72	3.7	224	277	eq_slo w
2015 12 14	16:25:0 7	20	104	5.3	301	129	eq_slo w
2015 12 14	16:25:1 6	21	64	3.3	181	287	eq_slo w
2015 12 14	16:25:2 8	22	8	0.5	308	277	speedy
2015 12 14	16:25:3 4	23	88	4.5	45	191	eq_slo w
2015 12 14	16:25:4 1	24	8	0.5	42	266	eq_slo w
2015 12 14	16:25:4 7	25	24	1.3	338	266	eq_slo w
2015 12 14	16:25:5 4	26	56	2.9	280	139	eq_slo w
2015 12 14	16:26:0 0	27	16	0.9	221	281	eq_slo w
2015 12 14	16:26:0 4	28	64	3.3	359	371	eq_slo w
2015 12 14	16:26:1 2	29	32	1.7	103	333	eq_slo w
2015 12 14	16:26:2 0	30	24	1.3	382	159	eq_slo w
2015 12 14	16:26:2 8	31	0	0.1	367	122	speedy
2015 12 14	16:26:3 3	32	88	4.5	235	376	eq_slo w
2015 12 14	16:26:3 8	33	80	4.1	356	335	eq_slo w
2015 12 14	16:26:4 7	34	0	0.1	317	119	speedy
2015 12 14	16:26:5 0	35	96	4.9	295	427	speedy

2015 12 14	16:27:0 0	36	0	0.1	291	198	speedy
2015 12 14	16:27:0 9	37	40	2.1	350	505	eq_slo w
2015 12 14	16:27:1 7	38	48	2.5	105	173	eq_slo w
2015 12 14	16:27:2 5	39	40	2.1	276	431	eq_slo w
2015 12 14	16:27:3 1	40	96	4.9	48	357	eq_slo w
2015 12 14	16:27:4 0	41	8	0.5	247	200	eq_slo w
2015 12 14	16:27:4 9	42	8	0.5	12	156	eq_slo w
2015 12 14	16:27:5 9	43	16	0.9	154	390	eq_slo w
2015 12 14	16:28:0 6	44	40	2.1	127	145	eq_slo w
2015 12 14	16:28:1 1	45	104	5.3	242	294	eq_slo w
2015 12 14	16:28:1 8	46	56	2.9	392	193	eq_slo w
2015 12 14	16:28:2 5	47	56	2.9	116	308	eq_slo w
2015 12 14	16:28:3 6	48	8	0.5	13	385	speedy
2015 12 14	16:28:5 4	49	16	0.9	291	343	eq_slo w
2015 12 14	16:28:5 9	50	24	1.3	291	421	eq_slo w
2015 12 14	16:29:0 3	51	104	5.3	323	503	eq_slo w
2015 12 14	16:29:0 9	52	40	2.1	371	505	eq_slo w
2015 12 14	16:29:1 3	53	104	5.3	41	504	eq_slo w

2015 12 14	16:29:2 2	54	16	0.9	182	271	eq_slo w
2015 12 14	16:29:2 7	55	8	0.5	256	408	speedy
2015 12 14	16:29:3 2	56	56	2.9	20	283	eq_slo w
2015 12 14	16:29:3 6	57	96	4.9	385	462	eq_slo w
2015 12 14	16:29:4 2	58	48	2.5	169	272	eq_slo w
2015 12 14	16:29:5 1	59	80	4.1	41	331	eq_slo w
2015 12 14	16:29:5 7	60	0	0.1	140	462	speedy
2015 12 14	16:30:0 5	61	80	4.1	389	414	eq_slo w
2015 12 14	16:30:1 1	62	0	0.1	230	252	speedy
2015 12 14	16:30:2 0	63	48	2.5	353	330	eq_slo w
2015 12 14	16:30:2 8	64	0	0.1	278	152	eq_slo w
2015 12 14	16:30:3 7	65	48	2.5	304	130	speedy
2015 12 14	16:30:4 6	66	24	1.3	55	225	eq_slo w
2015 12 14	16:30:5 2	67	88	4.5	165	245	speedy
2015 12 14	16:30:5 7	68	80	4.1	238	429	speedy
2015 12 14	16:31:0 2	69	16	0.9	282	343	speedy
2015 12 14	16:31:0 9	70	40	2.1	166	317	speedy
2015 12 14	16:31:1 5	71	96	4.9	301	351	eq_slo w

2015 12 14	16:31:2 3	72	48	2.5	272	421	eq_slo w
2015 12 14	16:31:3 2	73	0	0.1	140	210	speedy
2015 12 14	16:31:3 9	74	8	0.5	234	259	eq_slo w
2015 12 14	16:31:4 7	75	56	2.9	88	252	speedy
2015 12 14	16:31:5 3	76	56	2.9	257	200	eq_slo w
2015 12 14	16:32:0 4	77	64	3.3	78	266	eq_slo w
2015 12 14	16:32:1 0	78	32	1.7	181	505	eq_slo w
2015 12 14	16:32:2 1	79	72	3.7	227	213	eq_slo w
2015 12 14	16:32:3 0	80	64	3.3	26	407	eq_slo w
2015 12 14	16:32:4 2	81	16	0.9	193	283	eq_slo w
2015 12 14	16:32:5 4	82	0	0.1	209	405	speedy
2015 12 14	16:33:1 7	83	56	2.9	68	351	eq_slo w
2015 12 14	16:33:3 0	84	96	4.9	250	403	eq_slo w
2015 12 14	16:33:3 9	85	64	3.3	377	412	eq_slo w
2015 12 14	16:33:5 4	86	88	4.5	137	181	speedy
2015 12 14	16:34:0 1	87	24	1.3	284	163	eq_slo w
2015 12 14	16:34:0 8	88	104	5.3	48	185	eq_slo w
2015 12 14	16:34:1 4	89	0	0.1	95	485	speedy

2015 12 14	16:34:3 3	90	24	1.3	188	138	eq_slo w
2015 12 14	16:34:4 2	91	32	1.7	331	504	eq_slo w
2015 12 14	16:34:5 0	92	80	4.1	282	165	eq_slo w
2015 12 14	16:35:0 1	93	88	4.5	210	229	speedy
2015 12 14	16:35:0 5	94	104	5.3	334	366	eq_slo w
2015 12 14	16:35:1 3	95	40	2.1	65	370	eq_slo w
2015 12 14	16:35:3 3	96	96	4.9	174	223	speedy
2015 12 14	16:36:0 3	97	104	5.3	119	393	eq_slo w
2015 12 14	16:36:1 9	98	104	5.3	355	208	eq_slo w
2015 12 14	16:36:2 6	99	40	2.1	78	363	eq_slo w
2015 12 14	16:36:3 4	100	16	0.9	257	277	eq_slo w
2015 12 14	16:36:4 3	101	24	1.3	81	461	eq_slo w
2015 12 14	16:36:5 0	102	48	2.5	330	193	eq_slo w
2015 12 14	16:36:5 7	103	80	4.1	385	152	eq_slo w
2015 12 14	16:37:0 4	104	96	4.9	48	124	eq_slo w
2015 12 14	16:37:1 4	105	16	0.9	153	235	eq_slo w
2015 12 14	16:37:3 7	106	24	1.3	285	505	speedy
2015 12 14	16:37:3 9	107	16	0.9	242	385	speedy

2015 12 14	16:37:4 4	108	88	4.5	161	235	speedy
2015 12 14	16:37:5 1	109	48	2.5	20	251	speedy
2015 12 14	16:37:5 8	110	32	1.7	12	436	eq_slo w
2015 12 14	16:38:0 4	111	96	4.9	271	204	eq_slo w
2015 12 14	16:38:1 1	112	48	2.5	357	229	eq_slo w
2015 12 14	16:38:1 6	113	48	2.5	94	200	speedy
2015 12 14	16:38:2 4	114	40	2.1	191	400	speedy
2015 12 14	16:38:3 0	115	96	4.9	333	142	eq_slo w
2015 12 14	16:38:3 6	116	104	5.3	8	237	eq_slo w
2015 12 14	16:38:4 2	117	48	2.5	176	166	eq_slo w
2015 12 14	16:38:4 9	118	24	1.3	200	366	eq_slo w
2015 12 14	16:38:5 3	119	8	0.5	396	469	speedy
2015 12 14	16:39:0 7	120	96	4.9	241	312	eq_slo w
2015 12 14	16:39:3 5	121	80	4.1	119	135	speedy
2015 12 14	16:39:4 3	122	48	2.5	216	155	eq_slo w
2015 12 14	16:39:4 8	123	80	4.1	355	327	eq_slo w
2015 12 14	16:39:5 3	124	64	3.3	81	254	eq_slo w
2015 12 14	16:39:5 9	125	48	2.5	369	321	eq_slo w

2015 12 14	16:40:1 1	126	96	4.9	174	116	eq_slo w
2015 12 14	16:40:1 5	127	0	0.1	387	460	speedy
2015 12 14	16:40:2 2	128	24	1.3	36	385	eq_slo w
2015 12 14	16:40:2 8	129	72	3.7	29	278	eq_slo w
2015 12 14	16:40:3 3	130	80	4.1	362	251	eq_slo w
2015 12 14	16:40:3 9	131	56	2.9	355	471	speedy
2015 12 14	16:40:4 5	132	0	0.1	260	240	speedy
2015 12 14	16:40:4 9	133	0	0.1	309	430	speedy
2015 12 14	16:41:0 1	134	104	5.3	221	145	eq_slo w
2015 12 14	16:41:0 8	135	24	1.3	303	394	eq_slo w
2015 12 14	16:41:1 4	136	40	2.1	52	272	eq_slo w
2015 12 14	16:41:2 3	137	40	2.1	294	499	eq_slo w
2015 12 14	16:41:4 1	138	40	2.1	263	164	eq_slo w
2015 12 14	16:41:5 5	139	64	3.3	206	327	eq_slo w
2015 12 14	16:42:0 2	140	40	2.1	40	498	eq_slo w
2015 12 14	16:42:1 0	141	8	0.5	251	337	eq_slo w
2015 12 14	16:42:1 5	142	16	0.9	370	336	eq_slo w
2015 12 14	16:42:2 2	143	32	1.7	80	161	eq_slo w

2015 12 14	16:42:2 9	144	48	2.5	73	195	eq_slo w
2015 12 14	16:42:3 6	145	72	3.7	183	131	eq_slo w
2015 12 14	16:42:4 5	146	0	0.1	395	153	speedy
2015 12 14	16:42:5 1	147	56	2.9	50	437	speedy
2015 12 14	16:42:5 5	148	32	1.7	122	377	eq_slo w
2015 12 14	16:43:3 6	149	88	4.5	388	353	eq_slo w
2015 12 14	16:43:4 0	150	104	5.3	78	434	speedy
2015 12 14	16:43:4 5	151	88	4.5	115	339	eq_slo w
2015 12 14	16:43:5 2	152	32	1.7	374	196	eq_slo w
2015 12 14	16:44:0 0	153	80	4.1	140	359	eq_slo w
2015 12 14	16:44:0 6	154	96	4.9	160	127	eq_slo w
2015 12 14	16:44:1 7	155	104	5.3	45	304	eq_slo w
2015 12 14	16:44:2 3	156	24	1.3	200	381	eq_slo w
2015 12 14	16:45:1 1	157	32	1.7	394	302	eq_slo w
2015 12 14	16:45:1 7	158	104	5.3	287	243	eq_slo w
2015 12 14	16:45:2 3	159	104	5.3	270	232	eq_slo w
2015 12 14	16:45:3 3	160	64	3.3	166	206	eq_slo w
2015 12 14	16:45:3 8	161	88	4.5	365	390	eq_slo w

2015 12 14	16:45:4 4	162	24	1.3	96	257	eq_slo w
2015 12 14	16:46:0 2	163	88	4.5	406	383	speedy
2015 12 14	16:46:0 8	164	56	2.9	337	208	eq_slo w
2015 12 14	16:46:2 4	165	80	4.1	102	188	speedy
2015 12 14	16:46:3 6	166	8	0.5	51	335	speedy
2015 12 14	16:46:5 4	167	64	3.3	215	115	eq_slo w
2015 12 14	16:47:0 0	168	0	0.1	230	219	speedy
2015 12 14	16:47:0 7	169	8	0.5	269	177	speedy
2015 12 14	16:47:1 6	170	48	2.5	324	123	eq_slo w
2015 12 14	16:47:2 4	171	16	0.9	333	274	speedy
2015 12 14	16:47:3 0	172	16	0.9	234	318	eq_slo w
2015 12 14	16:47:3 6	173	56	2.9	296	220	eq_slo w
2015 12 14	16:47:4 2	174	8	0.5	241	438	eq_slo w
2015 12 14	16:47:4 6	175	96	4.9	324	476	eq_slo w
2015 12 14	16:47:5 0	176	88	4.5	317	407	eq_slo w
2015 12 14	16:47:5 5	177	80	4.1	275	401	eq_slo w
2015 12 14	16:47:5 9	178	88	4.5	106	287	eq_slo w
2015 12 14	16:48:1 0	179	32	1.7	78	175	speedy

2015 12 14	16:48:1 5	180	72	3.7	27	310	eq_slo w
2015 12 14	16:48:2 1	181	72	3.7	9	246	eq_slo w
2015 12 14	16:48:2 9	182	72	3.7	406	386	speedy
2015 12 14	16:48:3 4	183	8	0.5	338	396	speedy
2015 12 14	16:48:3 9	184	80	4.1	220	452	speedy
2015 12 14	16:48:4 7	185	64	3.3	85	461	eq_slo w
2015 12 14	16:48:5 2	186	32	1.7	407	322	speedy
2015 12 14	16:49:0 0	187	8	0.5	257	135	eq_slo w
2015 12 14	16:49:1 0	188	72	3.7	8	396	eq_slo w
2015 12 14	16:49:1 7	189	64	3.3	80	307	eq_slo w
2015 12 14	16:49:2 3	190	64	3.3	254	261	eq_slo w
2015 12 14	16:50:2 7	191	72	3.7	393	388	eq_slo w
2015 12 14	16:50:3 4	192	80	4.1	311	121	eq_slo w
2015 12 14	16:50:4 1	193	24	1.3	341	140	eq_slo w
2015 12 14	16:50:4 6	194	32	1.7	293	346	eq_slo w
2015 12 14	16:50:4 9	195	72	3.7	243	404	eq_slo w
2015 12 14	16:51:1 4	196	24	1.3	253	491	speedy
2015 12 14	16:51:1 6	197	88	4.5	57	357	speedy

2015 12 14	16:51:1 8	198	32	1.7	284	309	speedy
2015 12 14	16:51:2 0	199	8	0.5	165	365	speedy
2015 12 14	16:51:2 2	200	72	3.7	40	478	speedy
2015 12 14	16:51:2 4	201	56	2.9	100	511	speedy
2015 12 14	16:51:2 6	202	64	3.3	252	182	speedy
2015 12 14	16:51:4 0	203	64	3.3	54	147	speedy
2015 12 14	16:51:5 4	204	72	3.7	20	369	speedy
2015 12 14	16:52:0 2	205	88	4.5	5	155	eq_slo w
2015 12 14	16:52:1 0	206	64	3.3	94	155	eq_slo w
2015 12 14	16:52:2 0	207	72	3.7	189	156	speedy
2015 12 14	16:52:2 6	208	56	2.9	25	381	speedy
2015 12 14	16:52:3 4	209	72	3.7	161	435	eq_slo w
2015 12 14	16:52:4 2	210	72	3.7	37	299	eq_slo w