Title

The Effect of Set on Visual Perception



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# THE EFFECT OF SET ON VISUAL PERCEPTION

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## Introduction:

Hilgard (6,609) describes set as, "A preparatory adjustment or readiness for a particular kind of action or experience, usually coming about as a result of instructions, e.g., the set to respond with a word opposite in meaning to the stimulus word in an experiment on controlled association." Woodworth (10,624) sees perception as a kind of response and that this response is controlled by the central factors of set and meaning. He feels that any momentary stimulus is received in the brain already adjusted to the experience perceived. "Thus the immediately past experience is a very important factor which is embodied in the adjustment or set for the situation."

Siipola (8) using nonsense words tachistoscopically presented, measured the effect of set on the interpretation of ambiguous stimuli. By presenting two groups of 30 subjects each with the same nonsense words and suggesting to one group that the words would have something to do with travel or transportation and to the other that the words would have something to do with birds or animals he found that the "travel or transportation" oriented group responded 74% of the time with responses appropriate to the set and with "animal or bird" responses 11% of the time. Conversely, the "bird or animal" oriented group responded with "bird or animal" responses 63% of the time and with "travel or transportation" responses 14% of the time. The words presented were such that they could be seen either way, e.g., the word "wharl" being seen as either "whale"

or "wharf".

Bruner and Postman (3) examined the effect of tendency to relate new or novel experience to the familiar. By exhibiting incongruous playing cards such as a red four of spades they found that 27 out of 28 subjects named it either as a red four of hearts or a black four of spades on the first meeting. They also found that once the subjects had identified an incongruous card their perceptual readiness changed so that they expected incongruous cards, and, as a consequence, when incongruous cards were again presented they made fewer false identifications. Bruner, Postman and Rodrigues (4) further substantiate this with an experiment in the influence of set on color matching. Subjects were shown two dimensional objects such as fruit, and were asked to match the painted colors of the object against a color wheel. The subjects saw the object first and turned away from the object to match it on the color wheel. There was a marked tendency to match the color with the natural color of the object rather than the color it was painted. Langfeld (7) showed that subjects were willing to accept as high 47% of his false suggestions as interpretations of facial expressions even though subjects had previously correctly named the expressions.

One of the tasks of the present experiment is to present a visual stimulus with which there would be no past associations so that any set which was introduced could be considered as the basic influencing factor. It was felt that previous associations or subjective orientations might offer a contaminating effect or present a possible conflict situation. A possible method was using an unfamiliar and illusory perception, thereby allowing for

ambiguity in the perception. Finding that subjects had not been shown the "Ames trapezoidal window demonstration" it was decided to use this as a basis for the experiment.

Procedure:

Apparatus: The apparatus consisted of a copy of the Ames trapezoidal window as shown in figure 1. The window is mounted on a shaft which projects vertically from a 2 r.p.m. motor. Due to the perspective cues incorporated in the illusion, it is viewed in a darkened room with small lights placed properly and the illusion set so that there is little or no frames of reference, there is a general tendency to see the window as oscillating rather than revolving. The illusion is further enhanced by either monocular viewing or by binocular viewing at distances in excess of fifteen feet. If the bar is placed so that it hangs from the center lateral support and projects through the lower center pane, the window seems to continue to oscillate while the bar, having no perspective cues, continues to revolve. Hence, there is an incongruity present, the bar seemingly traveling in the same direction as the window for a part of the cycle and in an opposite direction for the balance of the cycle. The subject, therefore, must compensate for this incongruity in some manner, and usually does so by either "seeing" the bar bend in a sort of modified "S" or "seeing" it "cutting through" the pane.

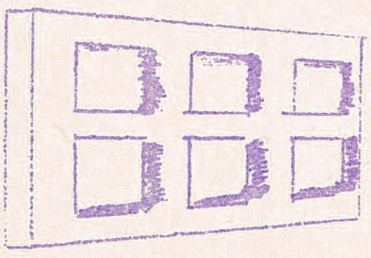

Figure 1

Subjects: The subjects were students in four different sections of courses in General Psychology. The N's were 33, 25, 21, and 35 respectively. Classes were chosen on the basis of availability and naivete with reference to the Ames demonstrations. Inasmuch as the course is a general education requirement for all students at the college, there is a cross-sectional representation from all major fields. Random selection was used to determine which sections would receive what "set".

Methodology: The subjects were shown the illusion, being given time to see the oscillating effect after being told of the effect that was to be seen. (Actual instructions as read appear in appendix A. Note: Explanations of terms used in the appendices appear on the page preceeding the appendices.) The illusion was stopped and the bar was hung by two fine threads inserted through the center pane. As the illusion was then run the subjects were instructed that they would see it either (1) "cut through" or, (2) "bend about" or, (3) "either cut through or bend about" or, (4) given no information as to what to expect. The lights were then turned on and the illusion was stopped. A questionnaire was then passed out which corresponded to the given "set", group #1 being given question #1 etc. The subjects were asked to not sign their names and to try to give an honest answer. The subjects were also asked at the beginning to please not talk until the experiment was over. The actual questions used are shown in appendix B.

Results:

The data most pertinent to the comparasion of "set" response is the mean percentage of "set" agreement answers. However, this measure is somewhat lowered by the fact that there

was a propensity on the part of the subjects in the unstructured situation to "see" a particular event. As seen in Table 1, subjects tended to see, in an unstructured situation having been given no set, the bar "cutting" through. This tendency is used as the basic "normal" sample and calculations proceed from this base.

Table 1

| | Cut set | Bend Set | Either set | No set |
|---|---|---|---|---|
| Respond cut | 33 | 1 | 10 | 22 |
| Respond bend | 0 | 21 | 6 | 1 |
| Uncl. response | 0 | 3 | 0 | 11 |
| Respond both | 0 | 0 | 5 | 0 |

Table 1 indicates that there were four different categories of responses. Since it can be seen (Appendix B) that the subjects could agree with the "set" by checking a space or disagree by indicating what was seen, it was possible for subjects to see the opposite of the suggested set or see nothing at all. It was hoped that all answers could be categorized in either respond "cut" or respond "bend" categories. The results show that some subjects disagreed but either saw nothing or gave descriptions that were insufficient for categorical definition. Answers such as " bent around", "formed an 'S'","turned at the ends", etc. were accepted as indicating that the subject saw the bar bend; answers such as"cut through", "passed through", "cut the panes", etc. were accepted as indicating "cut". Some answers were not clearly indicative of either suggestion and so were grouped under "unclassifiable" responses. In the case of being set by the suggestion that either response was possible, there appeared a

fourth category in which subjects reported they saw both"cut" and "bend".

Appendix C gives the overall $X^2$ distribution for the 4 x 4 matrix. It is evident that there are significant differences at the .001 level. To take account of the basis of these differences, reference is made to appendix D. Comparing each of these classes against the "no" suggestion class, it can be seen that the major contribution of the differences stems from the class to which the "bend" suggestion was made. Since the "no" suggestion class basically "sees" the bar "cutting" there is more room for more effect as a result of the contrary suggestion. However, the class to which "cut" was suggested was sufficiently set by the suggestion to reveal significant differences at the .01 level.

Analysis of the comparison between the "either" suggestion class and the "no" suggestion class as shown in Appendix D must be looked at with the logic of the data in mind. The chi square reveals that if all cells are included there are significant differences at the .001 level. If all cells with an expected f of less than 2 are dropped it is still significant at the .001 level. If all cells with an expected f of less than 3 are dropped it is still significant at the .01 level, and if all cells with an expected f of less than 4 are dropped it is still significant at the .02 level. Guilford (5,235) notes that in a 2 x 2 table the Yates' correction for continuity can be applied to take care of small expected frequencies, however it is not applicable to tables with more than 1 degree of freedom. He further notes that the need for correction is not as great in larger tables

and that it can be overcome by combining categories. However, here the combining of categories would defeat the information revealed by the data. Applying the results of this 2 x 4 table shows a significance at the .02 level if all cells with expected frequencies of less than 4 are deducted. In the face of the fact that the same N is maintained while the cell effects are completely lost, the significance would seem greater than indicated. This would be substantiated by the fact that the class to which the "either" suggestion was made was the only class to indicate a response of "both". Answering "both" to the question necessitated the writing of an answer rather than simply checking off an answer. Additionally, this is the only class which supplied no "unclassifiable" answers.

The results can justifiably be said to indicate that under the particular presentation of this illusion subjects tend to "see" the bar "cutting" through the panes. If the subject is given a "cut" set it heightens the illusion of "cutting"; if subjects are given a "bend" set they tend to see it "bend" to a great extent while losing the illusion of "cutting"; if subjects are given an "either"sset they tend to exhibit a response that is closer to chance but is weighted by their natural tendency to see it "cut", additionally, the "either" set seems to influence subjects to see "both" phenomena.

Discussion:

Since this experiment was based on the theory that set will influence visual perception, the statistical tests of difference among separate classes support the original hypothesis. This is in line with the experimental results cited in the "Introduction".

The point of departure lies in the fact that subjects had no familiarity with the stimulus used and consequently no antecedent set. Although the antecedent set is a necessary concomitant of the experiments cited and the results show significant differences from the assumed set, there is no way to measure the strength of this antecedent set and consequently no measure of the strength of the induced set.

Two questions must be considered in relation to the results of this experiment; (1) Is there any previous set that may influence these data and if so is it measureable or controllable and, (2) Is there any tendency on the part of the subjects to "help" the experimenter by answering as they feel the experimenter would "like" them to?

In examining some further aspects of set the same experimental apparatus with the same given set was used. However, the questionnaire distributed did not necessarily agree with the given set. The classes were drawn from other sections of General Psychology. Inadvertently, a class was included which it was later learned had seen the film of the Ames' demonstrations. The film generally gives the impression that the bar "bends". This was substantiated by questioning the class after this experience was learned. The experimenter had given the suggestion, "cut", but the question distributed was question #4, an open ended one. From an N of 17, 12 reported seeing the bar "cut" and the other 5 answers were "unclassifiable". Appendix E examines these data comparing them with "no" set and "cut" set in the present experiment. Since they were given a "cut" set it would be expected that

they would not differ significantly from this class in the present experiment.

However, the data indicate quite the opposite; there is a significant difference at the .01 level with the present "cut" class but the null hypothesis must be accepted in the case of the comparison with the present "no" set class. There would then seem to be a strong indication that previous set would have a marked effect on any set which is experimentally induced. There would therefore be an assumption of a previous "normal" set in which the class with "no" suggestion would respond "bend" significantly. On the basis of this assumption, Appendix F compares this class against the "bend" suggested class of this experiment. The differences here are significant at the .001 level. Hence it would seem that the previous "bend" set was overcome by the present "cut" set but significantly different from the extent that a naive class was set by the "cut".

The subjects seemed intensely interested in the experiment and it was felt that rapport was established. Although the subjects were specifically requested to answer honestly and cautioned not to sign their names, there is always the possibility that they were anxious to "help". However, reference to Table 1 will show that of the "bend" set class there were 4 out of 25 who did not see the set and answered so; from the "either" set class there were 5 out of 21. This would indicate that in light of previous findings and the inferences presented here that the various samples tried to do an objective job of answering. Since

they were requested to cooperate by answering honestly, it is more likely that any desire on their part to "help" would be directed toward an attempt at objectively stating what they seem to see.

There is a definate indication then, that on the basis and within the scope of these findings that set can definately influence what a subject seems to see. There is also the notion that those things which a subject tends "naturally" to see can be reinforced by set in the same direction. However, it still seems possible to change this tendency to some degree by a set. The indication is that there is some sort of a gradient between degree of previous set and change by the induced set, but whether this relationship is linear, logarithmic, exponential or some other form cannot be concluded on the basis of these data. Further work may reveal this possible relationship.

Summary:

The effect of set on perception was studied by using the Ames' trapezoidal window as the stimulus. Subjects from four classes in General Psychology acted as experimental groups. Each class was given a different set, one class being told that the bar would appear to cut the pane, one that it would appear to bend about the pane, one that either one or the other would appear to happen and the fourth class was given no set. Each class answered questionnaire on what appeared to them to be happening. Differences among the responses to the various sets are significant. Using $\chi^2$ distribution, overall differences are significant at the .001 level. Inter class differences are signi-

ficant at the .001 level between "bend" and "no" suggestion; at the .001 level between cut and "no" suggestion; at the .02 level between "either" and Hno" suggestion. Additionally, a fifth class, which had seen a film on the Ames' demonstrations was compared after suggestion. The previous set introduced by the seeing of the film was sufficiently effective to cause significant differences between the set from the film and the set from the experiment.

Using unfamiliar and illusory perception the experimental findings bore out the results obtained by previous experimenters in the field.

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## Explanatory Notes to the Appendices

Appendix B

Class - Section of General Psychology used as a group of subjects. Class number is random and does not identify a particular section.

Appendices C,D,E,F

Columns identify the set given to the class.

Rows identify the responses, e.g., "Cut group" are those subjects who responded cut to the set given in the column.

Uncl. are those responses which could not be properly fixed as to meaning and so were called "unclassified".

exp. = expected frequency of response.

obs. = observed frequency of response.

Appendix A

General instructions for all classes

This is a demonstration of the trapezoidal window as suggested by the Ames demonstrations in perception. It is used to show how we perceive things, what cues we use, what frames of reference. While we are interested in showing you this for your information, we are also interested in collecting some data for our information. Therefore, I am going to ask that you cooperate by observing certain practices during the demonstration. First, please do not discuss this with your neighbor or talk to anyone until after you have filled out the short questionnaire which I will distribute after the demonstration. Second, as the lights are turned out please place one hand over your left eye so as to keep it closed during the demonstration. (THE LIGHTS ARE TURNED OUT AND THE ILLUSION IS STARTED.) You will notice that the window seems to go back and forth, seeming to oscillate. If you do not seem to see this shift your head slightly until you do. (ALLOW THE ILLUSION TO RUN FOR FOUR MINUTES, EIGHT REVOLUTIONS. STOP THE ILLUSION AND PUT THE BAR IN POSITION.)

**********

Further instructions for Class 1 (Cut set)

As you watch the illusion, the bar will seem to cut through the window, see if you see this.

**********

Further instructions for Class 2 (Bend set)

As you watch the illusion, the bar will seem to bend in an "S" about the window, see if you see this.

Further instructions for Class 3 (Either set)

As people view this they have either one of two sensations, the bar is cutting through the window or the bar is bending in an "S" about the window, see if you do see one or the other.

**********

Class 4 (No set) is given no instructions during this time.

**********

Further instructions for all classes

(ALLOW TO RUN FOR FOUR MINUTES, EIGHT REVOLUTIONS. TURN ON LIGHTS AND STOP ILLUSION.) I am going to distribute a short questionnaire to each of you, please do not sign your name. For the purposes of data, I am going to ask that you answer completely honestly, the anonimity will be preserved. It should not take more than thirty seconds to a minute to answer the questionnaire. (PASS OUT QUESTIONNAIRE BUT DO NOT TALK OR ANSWER ANY QUESTIONS UNTIL ALL THE SLIPS HAVE BEEN COLLECTED.)

Appendix B

Class 1 Cut set question

Please put a check mark on the appropriate line.

The bar appeared to cut through the window. Yes____ No____

If no, then what did you seem to see?_____

_____

Class 2 Bend set question

Please put a check mark on the appropriate line.

The bar appeared to bend about the window. Yes____ No____

If no, then what did you seem to see?_____

_____

Class 3 Either set question

Please put a check mark on the appropriate line.

The bar appeared to cut through the window._____

The bar appeared to bend about the window._____

Other_____

_____

Class 4 No set question

Briefly describe what you seemed to see as far as the relationship between bar and window.

_____

_____

_____

Appendix C

## Overall $\chi^2$ distribution

Set

| | Cut | Bend | Either | None | Total |
|---|---|---|---|---|---|
| Cut group exp. | 19.27 | 14.60 | 12.26 | 19.85 | |
| Cut group obs. | 33 | 1 | 10 | 22 | 66 |
| Bend group exp. | 8.18 | 6.19 | 5.20 | 8.42 | |
| Bend group obs. | 0 | 21 | 6 | 1 | 28 |
| Uncl. gr. exp. | 4.09 | 3.10 | 2.60 | 4.21 | |
| Uncl. gr. obs. | 0 | 3 | 0 | 11 | 14 |
| Both group exp. | 1.46 | 1.11 | .93 | 1.5 | |
| Both group obs. | 0 | 0 | 5 | 0 | 5 |
| Total | 33 | 25 | 21 | 34 | 113=N |

$$\chi^2 = \frac{(33-19.27)^2}{19.27} + \frac{(1-14.60)^2}{14.60} + \frac{(10-12.26)^2}{12.26} + \frac{(22-19.85)^2}{19.85} +$$

$$\frac{(0-8.18)^2}{8.18} + \frac{(21-6.19)^2}{6.19} + \frac{(6-5.20)^2}{5.20} + \frac{(1-8.42)^2}{8.42} +$$

$$\frac{(0-4.09)^2}{4.09} + \frac{(3-3.10)^2}{3.10} + \frac{(0-2.60)^2}{2.60} + \frac{(11-4.21)^2}{4.21} +$$

$$\frac{(0-1.46)^2}{1.46} + \frac{(0-1.11)^2}{1.11} + \frac{(5-.93)^2}{.93} + \frac{(0-1.5)^2}{1.5} = 112.53$$

at df = 9 significant at .001 level

Contribution of cells with expected f of less than 5

$$= \frac{(0-4.09)^2}{4.09} + \frac{(3-3.10)^2}{3.10} + \frac{(0-2.60)^2}{2.60} + \frac{(11-4.21)^2}{4.21} +$$

$$\frac{(0-1.46)^2}{1.46} + \frac{(0-1.11)^2}{1.11} + \frac{(5-.93)^2}{.93} + \frac{(0-1.50)^2}{1.50} = 39.55$$

112.53 - 39.55 = 72.98 significant at .001 level with df=9

Appendix D

Comparison of suggested bend vs. no suggestion

| | Set: Bend | None | Total |
|---|---|---|---|
| Cut group exp. | 9.73 | 13.25 | |
| Cut group obs. | 1 | 22 | 23 |
| Bend group exp. | 9.31 | 12.67 | |
| Bend group obs. | 21 | 1 | 22 |
| Uncl. group exp. | 5.92 | 8.06 | |
| Uncl. group obs. | 3 | 11 | 14 |
| Total | 25 | 34 | 59=N |

$$\chi^2 = \frac{(1-9.73)^2}{9.73} + \frac{(22-13.25)^2}{13.25} + \frac{(21-9.31)^2}{9.31} + \frac{(1-12.67)^2}{12.67} + \frac{(3-5.92)^2}{5.92} + \frac{(11-8.06)^2}{8.06} = 41.55 \text{ at 2df sig. at .001 level}$$

Comparison of suggested cot vs. no suggestion

| | Set: Cut | None | Total |
|---|---|---|---|
| Cut group exp. | 27.06 | 27.89 | |
| Cut group obs. | 33 | 22 | 55 |
| Bend group exp. | .49 | .51 | |
| Bend group obs. | 0 | 1 | 1 |
| Uncl. group exp. | 5.41 | 8.06 | |
| Uncl. group obs. | 0 | 11 | 11 |
| Total | 33 | 34 | 67=N |

$$\chi^2 = \frac{(33-27.06)^2}{27.06} + \frac{(22-27.89)^2}{27.89} + \frac{(0-.49)^2}{.49} + \frac{(1-.51)^2}{.51} + (0-5.41)^2 + (11-8.06)^2 = 14.20 \text{ at 2df sig. at .001 level}$$

Contribution of cells with expected f of less than 5

$$= \frac{(0-.49)^2}{.49} + \frac{(1-.51)^2}{.51} = .96 \quad 14.20-.96=13.24 \text{ at 2df sig. at.01 level}$$

Comparison of either suggestion vs. no suggestion

Set

| | Either | None | Total |
|---|---|---|---|
| Cut group exp. | 12.19 | 19.78 | |
| Cut group obs. | 10 | 22 | 32 |
| Bend group exp. | 2.67 | 4.33 | |
| Bend group obs. | 6 | 1 | 7 |
| Uncl. group exp. | 4.19 | 6.80 | |
| Uncl. group obs. | 0 | 11 | 11 |
| Both group exp. | 1.91 | 3.09 | |
| Both group obs. | 5 | 0 | 5 |
| Total | 21 | 34 | 55=N |

$$\chi^2 = \frac{(10-12.19)^2}{12.19} + \frac{(22-19.78)^2}{19.78} + \frac{(6-2.67)^2}{2.67} + \frac{(1-4.33)^2}{4.33} +$$

$$\frac{(0-4.19)^2}{4.19} + \frac{(11-6.80)^2}{6.80} + \frac{(5-1.91)^2}{1.91} + \frac{(0-3.09)^2}{3.09} = 22.18$$

22.18 significant at .001 level at 3df

Contribution of cells with expected f of less than 2

$\frac{(5-1.91)^2}{1.91} = 4.93$ 22.18-4.93 = 17.25 significant at .001 level

Contribution of cells with expected f of less than 3

$\frac{(6-2.67)^2}{2.67} = 4.19$ 17.25-4.19 = 13.10 significant at .01 level

Contribution of cells with expected f of less than 4

$\frac{(0-3.09)^2}{3.09} = 3.09$ 13.10-3.09 = 10.01 significant at .02 level

## Appendix E

Comparison of previous bend set vs. no suggestion

| | Set: Cut* | Set: None | Total |
|---|---|---|---|
| Cut group exp. | 11.32 | 22.64 | |
| Cut group obs. | 12 | 22 | 34 |
| Bend group exp. | 5.33 | 10.66 | |
| Bend group obs. | 5 | 11 | 16 |
| Uncl. group exp. | .33 | .67 | |
| Uncl. group obs. | 0 | 1 | 1 |
| Total | 17 | 34 | 51=N |

Applying Yates' correction for continuity

$$\chi = \frac{[(12-11.32)-.5]^2}{11.32} + \frac{[(22-22.64)-.5]^2}{22.64} + \frac{[(5-5.33)-.5]^2}{5.33} + \frac{[(11-10.56)-.5]^2}{10.56} +$$

$$[(0-.33)-.5]^2 + [(1-.67)-.5]^2 = .01 \text{ not significant}$$

Comparison of previous bend set vs. cut suggestion

| | Set: Cut* | Set: Cut** | Total |
|---|---|---|---|
| Cut group exp. | 15.30 | 29.70 | |
| Cut group obs. | 12 | 33 | 45 |
| Bend group exp. | 1.70 | 3.30 | |
| Bend group obs. | 5 | 0 | 5 |
| Total | 17 | 33 | 50=N |

Applying Yates' correction for continuity

$$\chi = \frac{[(12-15.30)-.5]^2}{15.30} + \frac{[(33-29.70)-.5]^2}{29.70} + \frac{[(5-1.70)-.5]^2}{1.70} +$$

$$[(0-3.30)-.5]^2 = 7.76 \text{ at 1df significant at .01 level}$$

*= Class given cut set but sophisticated by having seen film with consequent "previous bend set".

**= Class given but set with no previous exposure.

Appendix F

Comparison of previous bend set vs. bend suggestion

| | Set: Cut* | Set: Bend | Total |
|---|---|---|---|
| Cut group exp. | 5.25 | 7.74 | |
| Cut group obs. | 12 | 1 | 13 |
| Bend group exp. | 8.48 | 12.50 | |
| Bend group obs. | 0 | 21 | 21 |
| Uncl. group exp. | 3.23 | 4.76 | |
| Uncl. group obs. | 5 | 3 | 8 |
| Total | 25 | 17 | 42=N |

Applying Yates' correction for continuity

$$\chi^2=\frac{[(12-5.25)-.5]^2}{5.25}+\frac{[(1-7.74)-.5]^2}{7.74}+\frac{[(0-8.48)-.5]^2}{8.48}+\frac{[(21-12.50)-.5]^2}{12.50}+$$

$$\frac{[(5-3.23)-.5]^2}{3.23}+\frac{[(3-4.76)-.5]^2}{4.76}=25.89 \text{ at 2df significant at .001 level}$$

*=Class given cut set but sophisticated by having seen film with consequent "previous bend set".