A SYSTEMATIC STUDY OF END ANCHORING

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ABSTRACT

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END ANCHORING

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An experiment was designed to investigate and clarify the concept of anchoring. Anchoring was defined as the special way in which certain response categories appear tied to certain stimuli.

Seven stimulus sets were selected from a systematically varied stimulus series. The complete stimulus series was composed of thirty-seven photographic slides, each containing thirty-six blue and green dots such that the entire series varied systematically from an all-blue slide to an all-green slide. This permitted the experimenter to control the color mass of the stimuli selected for presentation.

An eleven-point scale was used to express judgments. Seventy subjects were recruited from introductory psychology courses, and were randomly assigned to groups of five subjects. Half of the subjects judged greenness, and half judged blueness.

The main argument of the experiment was that the salience of a stimulus, rather than its placement in the series, determined anchoring. A salient stimulus was defined as a stimulus that is easily noticeable and readily associated with a response category.

Other hypotheses were offered relating the effectiveness of anchoring to the salience of the end stimuli, and the influence of anchoring upon judgments of adjacent stimuli to the salience of the end stimulus and to the distance of the judged stimuli from the end stimulus.

The data were analyzed in terms of errors, an error being defined as any incorrect association of a response category to a stimulus. An overall analysis of variance of errors indicated that the data gathered under the two color conditions could be combined into a single body of data. An overview of the data was then presented graphically by calculating the median and the interquartile range of judgments for each stimulus in a set. This analysis indicated that anchoring effects occurred as predicted.

Subsequently, an analysis of variance of errors for each set was run to provide a more refined analysis of the magnitude and extent of anchoring effects. Significant F-ratios were obtained on all sets with the exception of the mid-range set where no anchoring was predicted to occur. The F-ratios obtained decreased in significance as the salience of the end stimulus decreased, supporting the hypotheses.

It was suggested that current interpretations of anchoring would have to be revised to incorporate the concept of salience. The most acceptable interpretation is the subjective-standard hypothesis which embraces salience as the key concept for explaining the selection of a stimulus as the subjective standard. The data of this experiment indicated that anchoring is not primarily a function of the placement of a stimulus in a series. Rather, for a stimulus to act as an anchor, it must be easily identified and associated with a particular response category.

Approved Donald M. Johnson

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By

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INTRODUCTION

Stimulus Arrangements and Judgment Scales

In experiments involving the formation of a judgment scale relative to a specified stimulus series, it has been observed that the judgment scale is related to the stimuli judged in a generalized way: it corresponds to the judged stimuli in position and width. The judgment scale is said to be stimulus-anchored (Rogers, 1941), which is merely another way of describing the conformity of the scale to the stimulus series.

To be more specific, however, anchoring is considered to be the descriptive term for the special way in which certain response categories appear tied to certain stimuli (Johnson, 1955). As such, anchoring would seem to be intimately related to the experimental stimulus arrangement presented to the subject. The following three modal stimulus conditions have been described by Sherif and Hovland (1961).

1. Formation of a scale on the basis of a well-graded stimulus series having an explicit standard within it.

This arrangement is exemplified by experiments using the method of constant stimuli, in which for each stimulus presented for judgment, a comparison or standard is simultaneously presented, usually with a value near the middle stimulus of the series. The judgment scale formed using this method is more stable and better fitted to stimulus values near the value of the standard stimulus. According to Sherif and Hovland, this means that judgments are more accurate and less variable near the middle of the series.

2. Formation of a scale on the basis of a well-graded stimulus series without an explicit standard. This is synonymous with the method of single stimuli, also known as the method of absolute judgment, formally introduced into psychophysics by Wever and Zener in 1928. This technique consists of the single presentation of members of the stimulus series with the requirement that each stimulus be judged in absolute terms as it is presented. Through the repeated presentation of the stimulus series, the subject (S) gains knowledge of that series so that he is able to express an absolute judgment. The distribution of his judgments is called the "absolute series" or "absolute scale." When this method is used, it is the end stimuli

of the series which control oscillations in the judgment scale, according to Volkmann (1951), while the middle stimuli have no functional significance. As Needham (1935) stated it, it is as though S "first 'learns' to recognize the boundaries within which he is judging, and to assign to these limiting stimuli the relatively more correct judgments" (p. 282).

3. Formation of a scale without a graded stimulus series. This arrangement is perhaps most pertinent to social situations where social stimuli are complex and cannot easily be ordered along a dimension. Such a judgment scale would be highly influenced by internalized standards operating within S, such as attitudes, and by the judgments of other persons if estimates are given in the presence of other people.

Of the above three modal stimulus conditions, the one most commonly thought of in reference to anchoring is the method of single stimuli. In the first place, it demonstrates the fact that a judgment scale can be formed relative to a series of stimuli without the explicit introduction of a standard. Secondly, it can show the specific linkage between a response category and a stimulus in the absence of a standard. Furthermore, as a psychophysical method, it is more flexible than the method of constant stimuli: it permits greater manipulation of the stimulus series and the response scale. And it may be expected to yield more precise data than an ungraded series of stimuli.

Dependent Variables

Operationally, anchoring is generally described in terms of the effects of the independent variable on one or more of the following dependent variables: (1) frequencies of responses; (2) latencies of response; (3) variability of response; (4) confidence attending responses; (5) frequency of correct responses or the converse, frequency of errors.

Several writers (including Volkmann, 1951; Volkmann and Engen, 1961) have noted that the measurement of these dependent variables reveals the following effects, which have been taken as indications of anchoring. (1) A set of correlated changes in response-frequency known as a shift of a judgment scale. (2) A selectively decreased latency of responses. (3) A selectively decreased variability of responses. (4) A selectively increased confidence attending the judgment responses. (5) A selectively increased frequency of correct responses, or conversely, a selectively decreased frequency of errors.

Classification of Anchoring Effects

Experiments in anchoring specify the type of manipulation of the stimuli used to obtain the desired effect. Hence, it is feasible to classify anchoring in terms of these experimental operations (see Johnson, 1955, and Volkmann and Engen, 1961).

Anchoring effects may be correlated with specific stimulus values. Here we may speak of *supplied anchoring* and *end-anchoring*. In supplied anchoring, the anchoring stimulus is added to the range of stimuli to be judged. Its placement may be either within or outside the range of the stimulus series. Perhaps the best illustration of supplied anchoring comes from studies of *assimilation* and *contrast* effects, a term introduced by Rogers (1941). In a study using weights by Sherif, Taub, and Hovland (1958), it was hypothesized that (1) the introduction of anchors at or near the end points of the series will cause displacement of the distribution of judgments in the direction of the anchor (assimilation) and (2) the introduction of anchors at increasing distances from the upper and lower ends of the stimulus series will cause displacement of the distribution of judgments away from the anchor and the judgment scale will be constricted to fewer categories. The results of the experiment supported the hypotheses.

End anchoring, perhaps the best known type of anchoring, occurs as a function of both the range of stimuli used (Volkmann, 1951) and the ease of identification of the end points of the stimulus series (Johnson, 1955). Volkmann (1951) reports on an experiment in which triangular stimuli varied only in area. The smallest triangle was to be judged as "1," and the largest triangle as "7." The results indicated a higher frequency of errors in identifying the middle stimuli. Hence it is the end stimuli which are responsible for controlling the oscillations of the judgment scale.

Natural anchoring effects occur when the intrinsic character of a stimulus ties down a judgment category, independent of the specific stimulus series or the examiner's (E) instructions. A good example of a natural anchor in judging the inclination of lines is the vertical and the horizontal. Onley and Volkmann (1958) in a study of perpendicularity, had Ss adjust two straight lines to be mutually perpendicular in the absence of visual cues of the horizontal or vertical. They report that the subjective horizontal and vertical axes play a conspicuous role when S is adjusting two lines to be perpendicular. As the reference line increased in angular displacement, variability in perpendicularity increased.

An infrequent effect is <u>derived anchoring</u>. An anchor is derived from a discriminable aspect of the stimulus series and may represent a subjective act of the S. In the Onley and Volkmann study cited above, Ss also used a secondary set of reference axes corresponding to subjective coordinates tilted at 45° to the normal or primary axes. Volkmann and Engen report a study conducted by E. P. Reese (and others) in which an anchoring effect was found at the 45° angle as well as at the horizontal and the vertical. They believe that the S is subjectively bisecting the angle between 0° and 90°.

Anchoring may also occur via instruction without its being present in the stimulus series. Volkmann (1936) had his Ss first judge inclinations of lines without any anchor. He then told them to call the horizontal a "1" even though it was not presented. Anchoring then occurred. This is an example of the operation of an <u>internal anchor</u>.

With less methodological precision, the term "internal anchor" has also been used in studies of social judgment to describe the operation of an individual's attitudes and opinions. In this context, the attitude or opinion held by an individual in reference to a particular issue is said to anchor his judgments relative to that issue. This use of the term "internal anchor" is similar, if not analogous, to the concept of an internal frame of reference. Generally, in studies using this meaning of internal anchoring, the S's stand on an issue is determined and his placement of pertinent items on a scale is observed. For example, in a study by Secord, Bevan and Katz (1956), Ss were shown photographs of unknown Negroes and Caucasians, and were asked to judge the photographs on the basis of ten physiognomic traits associated with "Negroidness" and fifteen personality attributes commonly associated with stereotypes of Negroes. It was found that Ss' stands toward Negroes anchored their judgments. The more anti-Negro the judge, the more blantantly he attributed all physiognomic and stereotyped characteristics to a Negro, regardless of how Caucasian-like he appeared.

A novel phenomenon is that of <u>response-anchoring</u>. In an experiment conducted by Eriksen and Hake (1957), a circular hue continuum was used which avoided end-anchoring effects. Ss were required to name each hue as it was presented with a given number from 1 to 20. They found that Ss selected numbers at the ends of the response continuum as anchoring agents, regardless of the stimuli to which they were attached. This suggests that responses on the ends of an ordered set of responses can produce anchoring, just as end-stimuli produce anchoring.

Another rare type of anchoring occurs when there is a high degree of compatibility between a stimulus and a response. Fitts and Deininger (1954) found anchoring when a high degree of similarity exists between a stimulus and a response, such as attaching the response nonsense syllable YEL to the color yellow in judging hues. This seems to be an artifact of the experiment rather than a true case of anchoring.

Problems and Criticisms

Few studies offer any explicit reasons for the observed anchoring effects. While some interpretive hypotheses have been offered, and these will be presented in a later section, most fail to specify what qualities a stimulus possesses that cause judgments made in relation to it to be more accurate and less variable than others. In this thesis, the author will speak of the salience of a stimulus to mean that it is more noticeable than others. A stimulus that is salient is easily associated with a response.

That the salience of a stimulus can be defined leads to another criticism of experiments: many fail to construct a stimulus series that varies systematically and quantifiably among its elements. Hence, the possible influence of an unsystematically varied stimulus series upon the results cannot be ruled out. Furthermore, the series selected for study rarely contains all possible stimuli of the physical property being judged; that is, the stimulus series is somewhat arbitrarily defined, as opposed to being bounded as a natural consequence of its construction.

It follows that if the salience of the stimuli can be quantified and systematically varied, then anchoring may be studied under different conditions of stimulus salience, and the influence of a salient anchor upon other stimuli in the series can be observed. Ideally then, the stimulus series should vary in only one parameter; hence, observed effects of the stimulus condition upon judgments can be attributed to that experimentally controlled variation. A problem will now be posed that attempts to attribute anchoring to the salience of the stimuli using a stimulus series that is quantifiable and systematically varied. The argument will be introduced that the end of a stimulus series is an anchor only when the end stimulus is salient.

THE PROBLEM

The purpose of this study is to investigate end anchoring effects in stimulus sets selected from a parametrically lawful stimulus series, using consecutive intervals to express judgment. The stimulus series was constructed in such a manner that the physical, discriminable aspect, color mass, varied systematically from stimulus to stimulus along a continuum of blue and green. One of the end stimuli contained the maximal amount of blue mass, while the other end stimulus contained the maximal amount of green mass.

Any number of stimulus sets could be selected from the series such that color mass would be controlled by the E. Hence, it was possible to study anchoring when the end stimuli possesses varying degrees of salience.

Hypotheses

It was hypothesized that:

1. Anchoring effects will be maximal in those stimulus sets which include either of the end stimuli of the complete series since these are the most salient stimuli.

2. The effectiveness of the end stimuli as anchors will decrease as their salience decreases.
3. The anchoring effect will influence judgments of adjacent stimuli, with the influence decreasing as the distance of the judged stimuli from the end stimuli increases.
4. The influence of the anchor upon judgments of adjacent stimuli will decrease as the salience of the anchoring stimuli decreases.
5. Overall, it is the salience of the end stimulus which determines anchoring, not merely its position at the end of the stimulus set.

METHOD

Stimulus-Series

The complete stimulus series was composed of thirty-seven 1" x 1" photographic slides. Each slide was constructed of blue and green dots arranged in a naively random pattern, with a total of thirty-six dots on each slide. The ratio of blue to green dots was manipulated in such a way that a continuous series of stimuli was formed running from all blue dots to all green dots. That is, slide #0 contained no green dots and 36 blue dots; slide #1 contained 1 green dot and 35 blue dots; the middle slide, #18, contained 18 green dots and 18 blue dots; and so forth, with slide #35 containing 35 green dots and 1 blue dot and slide #36 containing 36 green dots and no blue dots. Hence, the slides were coded in terms of the number of green dots. The code number subtracted from 36 gives the number of blue dots. This stimulus construction followed Philip (1947).

The advantages of such a stimulus series are readily apparent: (1) The stimuli differ only in the desired parameters, the color mass of blue and green. This difference is systematic and easily controlled throughout the series. (2) It contains two salient stimuli (the monochromatic slides) as anchoring stimuli. (3) It contains gradations in stimuli such that anchoring effects could be observed in the absence of the monochromatic slides. (4) The range of stimuli represented allows for the selection of sections of the stimulus series for presentation in such a fashion that the salience of the end stimulus can be controlled. For purposes of this research, the stimulus series was divided into seven stimulus sets (see Table 2), each composed of eleven consecutive slides. This selection permits the observation of anchoring effects when the salience of the anchor decreases while the number of stimuli in the series is constant. The middle set was included to determine if anchoring would occur when the stimulus set does not contain any salient stimuli.

Judgment Scale

An eleven-point or eleven-category judgment scale was selected ranging from 0 to 10, one category for each judged stimulus. The stimulus property to be judged was, of course, stimulus color. Ss were asked to judge the "blueness" or "greenness" of each slide presented, expressing their judgments numerically. The "bluer" or "greener" the stimulus, the higher the S's numerical response; hence, the bluest or greenest slide would be called a 10, and the least blue or the least green slide would be called a 0. Half of the Ss judged "blueness," and half judged "greenness," hence there were two judgment conditions.

Apparatus

The apparatus used included a Viewlex manually-operated slide projector equipped with a Alphax variable speed, manually-operated tachistoscopic lens shutter. The shutter was set for a one-second presentation. With the aid of an assistant an inter-trial interval of approximately eight seconds was maintained.

The projection screen was placed at approximately 20 feet from the projector on each trial so that the size of the image remained constant. Although the viewing room was darkened, enough light remained to permit Ss to record their judgments.

Subjects

Seventy Ss were recruited from elementary psychology courses. Each S was randomly assigned to one of the fourteen experimental conditions (seven stimulus sets judged under two color conditions); thus there were five Ss in each condition. All five Ss were run simultaneously. The only criterion for recruitment was a verbal request that no color-blind students participate.

Procedure

Each S was given a mimeographed instruction and recording sheet. E read the instructions aloud to S, and then answered any questions that were raised. The stimulus set selected for presentation was then presented eight times. The slides were randomized for each presentation; orientation of the slide was changed at random for each presentation. The latter technique was introduced to minimize any extraneous cues that might appear in a slide, particularly any intrinsic pattern among the dots. There were eight possible orientations: forwards and backwards, and in either of those orientations the slide could be presented up, down, side-left, or side-right.

Following each of the first two presentations, E asked if there were any questions. Thereafter, no assistance was given. The first two presentations were considered to be practice trials and are, therefore, not included in the analysis. It was assumed that at least two trials would be necessary for S to establish some knowledge of what was expected of him and of the series of stimuli before him. An inspection of the data bears out this assumption.

Each stimulus was presented for one second, followed by an eight-second inter-trial interval. Approximately one minute intervened between set presentations. The whole procedure took about 40 minutes.

Discounting the first two presentations of the selected set, the amount of data gathered was as follows: each stimulus in a set was presented six times for judgment by five Ss. Hence, thirty judgments are available for each stimulus in a set.

RESULTS

It was first determined whether or not the data gathered under the two color conditions could be combined into a single body of data. This was desired because (1) it would double the amount of data, and (2) no hypotheses were concerned with the specific color being judged. A gross determination of the feasibility of combining data was obtained by running an overall analysis of variance of errors. Error, the dependent variable in this as well as all subsequent analyses of variance, is defined as any incorrect association of a response category to a stimulus. Since there was a judgment category for each stimulus in a set, errors could quickly be ascertained merely by subtracting the number of correct judgments from sixty, the total number of judgments given for any stimulus.

The results of the overall analysis of variance of errors are presented in Table 1. No significant difference exists between the two color conditions. Consequently, the data will be combined in all remaining analyses.

However, the differences among sets are highly significant. This offers a gross, but nonetheless important contribution to an understanding of anchoring: manipulation of the salience of the end anchor of a set does influence the number of errors made in judging stimuli within a set.

Table 1. Overall analysis of variance of errors.

Source	df	ss	ms	F
Set	6	4215.03	702.51	18.99*
Color	1	14.34	14.34	0.39
Set x Col	6	390.34	65.06	1.76
Within	140	5176.95	36.98	
Total	153	9796.66		

*Significant at .01 level.

The first statistical manipulation of the combined data was the calculation of medians and interquartile ranges for judgments of each stimulus of each set. These values, when plotted for judgments of each stimulus, provide a graphical overview of the data. The values were calculated by formulae set forth by Edwards (1958). Medians and interquartile ranges were used to give a better graphical description of the distribution of judgments since the latter were skewed at the anchored ends of the absolute scale. These medians and interquartile ranges are presented in Figure 1, with one graph for each combined stimulus set.

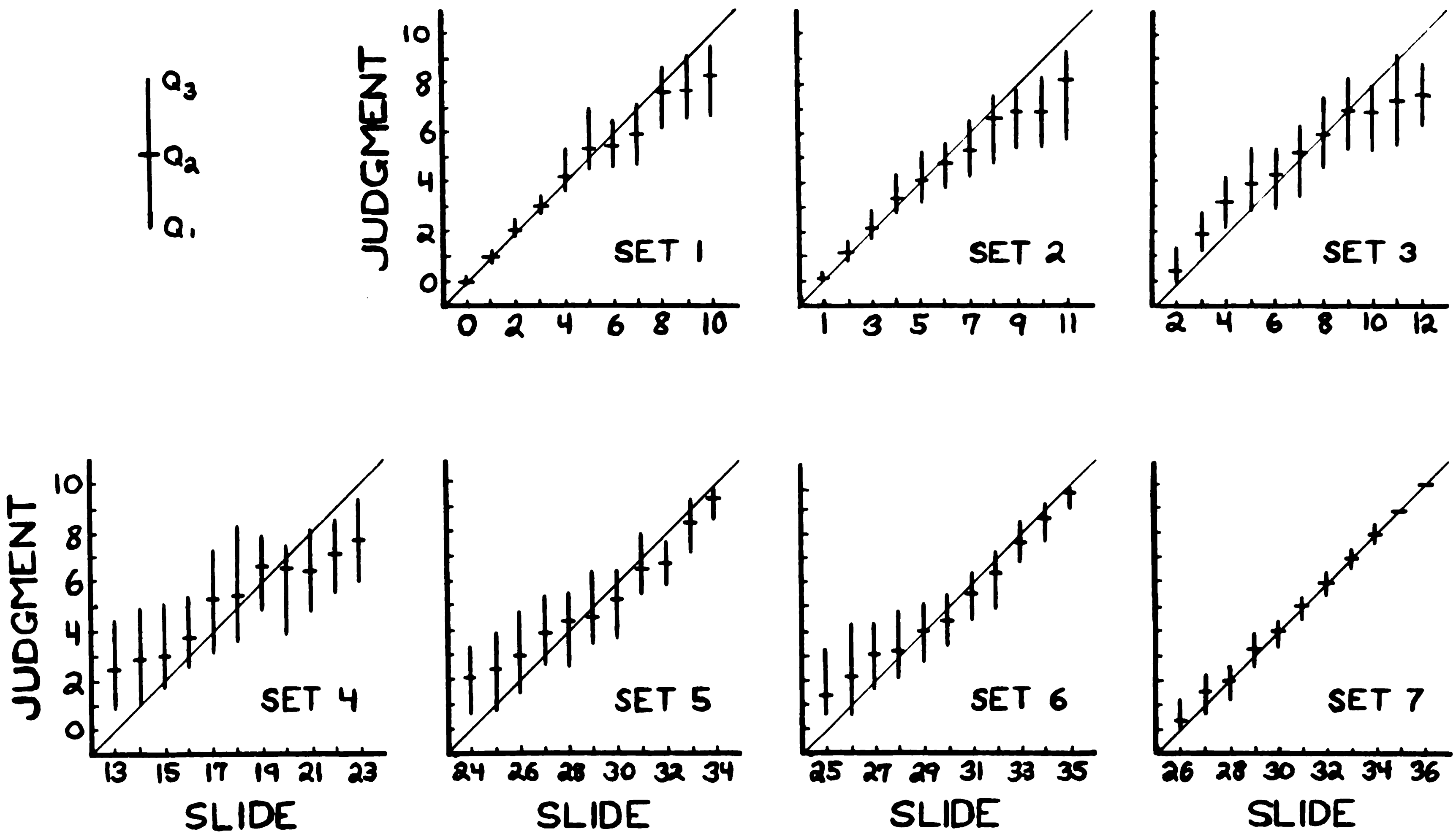

Figure 1. The effects of end anchoring on the dispersion of judgments of each slide in each set. The middle fifty percent of judgments is indicated by the vertical line. The median is indicated by the cross bar. The diagonal line represents correct judgment. To combine groups for graphical purposes the judgment scale for half the Ss was reversed.

This gross overview of the data indicates that anchoring occurred as predicted. The judgment scale is anchored to the salient stimulus in each set, with the exception of the middle set which did not contain a salient stimulus. The anchoring stimulus also exerts an influence upon the variability of judgments in adjacent categories, this influence being determined primarily by the salience of the anchoring stimulus and the distance of the judged stimulus from the anchor. Furthermore, it is not the end stimuli per se which anchor the judgment scale; had this been true, anchoring would have occurred at both ends of the sets and in the middle set. The salience of the stimulus appears to be the primary factor in anchoring.

The combined data were then analyzed as follows: each set was subjected to a Slides X Subjects Analysis of Variance (after Lindquist's Treatment X Subjects Design). The numerator of the F ratio was the mean square for slides and the denominator was the interaction mean square. The results are presented in Table 2. The mean errors for these data are shown in Table 3, which includes the critical difference values for making multiple comparisons among these means within sets (after Lindquist, p. 166).

Table 2. Analysis of variance of errors for each set.

Set	Source	df	ss	ms	F
Set 1:	Slides	10	298.76	29.876	22.858*
Slides	Subjects	9	82.37	9.152	
0-10	Sl x Subj	90	117.63	1.307	
	Total	109	498.76		
Set 2:	Slides	10	212.16	21.216	10.791*
Slides	Subjects	9	46.85	5.206	
1-11	Sl x Subj	90	176.95	1.966	
	Total	109	435.96		
Set 3:	Slides	10	43.07	4.307	3.059*
Slides	Subjects	9	25.04	2.782	
2-12	Sl x Subj	90	126.76	1.408	
	Total	109	194.87		
Set 4:	Slides	10	7.97	0.797	1.014 ns.
Slides	Subjects	9	8.04	0.893	
13-23	Sl x Subj	90	70.72	0.786	
	Total	109	86.73		
Set 5:	Slides	10	42.22	4.222	3.707*
Slides	Subjects	9	21.48	2.387	
24-34	Sl x Subj	90	102.52	1.139	
	Total	109	166.22		
Set 6:	Slides	10	79.10	7.910	4.287*
Slides	Subjects	9	125.99	13.998	
25-35	Sl x Subj	90	166.01	1.845	
	Total	109	401.35		
Set 7:	Slides	10	220.05	22.005	20.799*
Slides	Subjects	9	86.07	9.563	
26-36	Sl x Subj	90	95.23	1.058	
	Total	109	401.35		

*Significant at .01 level.

Table 3. Mean errors ($\bar{X}$) for each slide and critical difference values (CDV) for each set.

Set	Slides										
1:	0	1	2	3	4	5	6	7	8	9	10	CDV
$\bar{X}$:	0.2	1.1	1.6	1.8	3.4	3.8	4.7	4.8	4.4	5.1	4.5	1.35
2:	1	2	3	4	5	6	7	8	9	10	11	CDV
$\bar{X}$:	0.4	1.7	2.9	3.5	4.0	3.7	4.7	4.2	4.8	5.1	4.8	1.66
3:	2	3	4	5	6	7	8	9	10	11	12	CDV
$\bar{X}$:	3.0	4.4	4.6	4.7	4.9	5.1	4.7	5.2	5.0	5.2	5.5	1.40
4:	13	14	15	16	17	18	19	20	21	22	23	CDV
$\bar{X}$:	5.2	5.0	4.9	4.7	5.3	5.4	5.0	4.6	4.9	5.0	4.5	1.05
5:	24	25	26	27	28	29	30	31	32	33	34	CDV
$\bar{X}$:	4.6	5.0	5.1	4.9	5.4	4.8	4.6	5.1	4.8	4.1	3.0	1.26
6:	25	26	27	28	29	30	31	32	33	34	35	CDV
$\bar{X}$:	4.8	5.1	5.1	4.4	4.1	4.6	4.0	4.1	3.6	3.0	2.2	1.60
7:	26	27	28	29	30	31	32	33	34	35	36	CDV
$\bar{X}$:	2.4	3.9	3.3	3.5	2.7	1.6	0.9	0.6	0.2	0.0	0.0	1.21

Several conclusions, supportive of the hypotheses, can be drawn from an inspection of the data. The dependent variable in all cases is errors. Anchoring, or the influence of it, is thus indicated by a selective decrease in the frequency of errors made in judgment.

Anchoring is maximal in the two sets containing the end stimuli of the complete series. Errors are fewest in judging those two stimuli. Using the critical difference values in Table 3, the magnitude of difference in errors of judgment becomes significant at a point two slides removed from the most salient stimulus in Set 1, and five slides removed from the most salient stimulus in Set 7. The first hypothesis is supported.

As the salience, measured in color mass, of the end stimuli decreases, so does anchoring. That is, slide #1, the most salient stimulus in Set 2 is less effective in terms of errors than in slide #0, the most salient stimulus of Set 1. Slide #2, the most salient stimulus in Set 3, is less effective than either of the above anchors. A comparison of the most salient stimuli in Sets 5-7, in which green mass predominates, reveals similar findings. Hence, the effectiveness of the end stimuli as anchors, in terms of errors, decreases as their salience decreases. This supports the second hypothesis.

The third hypothesis is concerned with the effect anchoring has upon adjacent stimuli in the set. As the distance of the judged stimulus from the anchor increases, the number of errors in judging that stimulus will increase. This hypothesis is supported. An inspection of Table 3 indicates that errors increase as the distance of the judged stimulus from the anchor increases. At some point in reference to distance from the anchor, the number of errors becomes significantly greater than those made in judging the anchoring stimulus. The only set in which this does not hold true is the middle Set 4, in which there is no salient stimulus, and consequently, no anchoring.

The above hypothesis is intimately related to the fourth hypothesis which predicts that as the salience of the anchoring stimulus decreases, the number of errors occurring in judgments of adjacent stimuli increases. The data support this hypothesis. Not only do errors increase in judgments of adjacent stimuli as the salience of the anchor decreases; in the middle Set 4, in which no salient stimulus is present to anchor the judgment scale, errors are fairly evenly distributed across judgment categories and no significant differences exist among judgments of the stimuli.

Finally, the data support the proposal that salience determines anchoring. If anchoring occurred merely as a function of the end stimuli, without consideration for the salience of the end stimuli, then it should have occurred at both ends of all sets with approximately equivalent effectiveness. The data indicate, however, both that the number of errors increase as the salience of the end stimuli decreases, and that the significance of the differences in errors of judgment decreases as salience decreases. The middle Set 4 indicates that when there is little difference among the salience of the stimuli in a set, no anchoring will occur. These results indicate that the presence of anchoring and its influence upon adjacent stimuli hinges upon the salience of the stimuli.

DISCUSSION

While a considerable body of research literature exists on anchoring, most of it is descriptive in content, rather than interpretive. However, three interpretive hypotheses have been offered (Eriksen and Hake, 1957).

1. Response Attenuation Effect: This is considered to be an artifact of the absolute method. It is based upon the fact that errors in judgment of the end stimuli can occur only unidirectionally, while errors in responding to midrange stimuli can occur in two directions. However, this hypothesis is insufficient in itself, for the decrease in judgment variability at the anchoring stimuli is greater than that expected solely on the basis of unidirectional errors.

2. Discrimination and Stimulus Generalization: This interpretation assumes that for each value in the stimulus series a relatively symmetrical generalization gradient is set up in terms of the particular response that is assigned to that stimulus. For the mid-range stimuli, a number of overlapping generalization gradients would be formed. Consequently, the presentation of a stimulus in the middle

of the series would tend to elicit several responses besides the correct one. These competing responses would reduce the habit-strength of the correct response. However, for the end stimuli, the generalization gradients would be asymmetrical with a reduction in competing responses, and hence, fewer errors in judgment.

3. Subjective-Standard Hypothesis: This hypothesis is based upon the observation that judgments are always made relative to a standard or reference level that is subjectively present. This subjective standard is derived from a few selected stimuli that the S uses as standards for judging the remaining stimuli. Accordingly, then, the S transforms the task into a comparative judgment using the recalled value of the selected stimulus as a comparison stimulus.

This hypothesis assumes that, in the case of end anchoring, the S selects the end stimuli to use as his subjective standards. He frequently tries to recall the value of the end stimuli, and this increases the accuracy of recognition of these stimuli when they do appear. Furthermore, the accuracy of recognition of the other stimuli is directly related to the distance of these stimuli from the end stimuli. This relationship exists because the effectiveness of a standard is inversely related to the degree of similarity between the standard stimulus and the comparison stimulus.

Eriksen and Hake present a study which appears to support the subjective-standard hypothesis. They constructed a stimulus continuum of hues without any obvious end points. There could be no response attenuation because the subject could err in either direction. Stimulus generalization gradients would be approximately symmetrical for all stimuli; hence response competition would be about the same for all stimuli. But Ss would still be expected to select a few stimuli which they would use as standards to anchor their judgments. The data of the experiment support the subjective-standard hypothesis.

This hypothesis explains why a stimulus is selected as the standard. Herein we must introduce the concept of salience. For a stimulus to be selected as the subjective standard, it must be noticeable, conspicuous, or <u>salient</u>. If a stimulus is salient, then it will easily be associated with a particular response category.

This has been demonstrated in the experiment. In those stimulus sets containing a stimulus of maximum color mass, the fewest errors in judgment were made in judging that stimulus. However, as the salience of the end stimulus decreased so that it was less easily discriminated from other stimuli in the set, errors increased. When a set was introduced which contained no salient stimulus relative to the other stimuli in the set, no anchoring occurred. Hence, a stimulus must be noticeable if anchoring is to occur, and the more easily a stimulus is recognized, the more influential it is as an anchor.

Not only is there a significant decrease in errors in judging the most salient stimulus of a set, but there is also a decrease in errors in judging stimuli adjacent to the anchor. The more remote a stimulus is from the salient end stimulus, the more errors occur in judgment, until at some point along the stimulus continuum there ceases to be a significant decrease in errors. Moreover, the more salient the end stimulus, the further the significant decrease in errors extends along the stimulus continuum. Thus, the salient end stimulus influences judgments of adjacent stimuli, and the extent of this influence is determined by both the distance of a given stimulus from the end stimulus, and the degree of salience of the end stimulus.

When no salient stimulus appears in a set, errors are distributed rather evenly across all judgment categories. No anchoring occurs. Furthermore, when <u>one</u> of the end stimuli of a set is not readily noticeable, that is, when it cannot easily be distinguished from other stimuli, anchoring will not occur at that end of the stimulus set. Consequently, the generally accepted notion of end anchoring must be modified, for anchoring does not always occur at one or both ends of a stimulus set. For end anchoring to occur, one or both end stimuli must be easily identified as such. Moreover, a modified definition should also note that anchoring influences judgments of adjacent stimuli relative to the salience of the end stimuli and the distance of the judged stimulus from the end stimuli.

It should be noted that a regression effect is found in all seven stimulus sets. Regression occurs when the judgment scale and the stimulus series are not perfectly correlated. It is observed by regression in judgments toward the center of the judgment scale. In the data of this experiment, when perfect correspondence exists between the anchoring stimulus and the associated judgment category, all other judgments tend to be underestimated, and the size of the underestimation depends upon the distance of the judged stimulus from the anchor. As the salience of the anchor decreases, judgments of the lower end of the series tend to be overestimated, while those judgments of the upper end of the series tend to be underestimated. In the middle set in which there is no anchoring, overestimations are relatively similar in extent to underestimations. This supports Johnson's (1955) theory of regression.

Since anchoring is a function of the salience of the end stimulus in end anchoring, it might then be predicted that as the salience of an anchor decreases, the correlation between the stimulus series and the judgment scale would also decrease. That is, regression would also depend upon anchoring. The relationship between regression and anchoring would be an interesting topic for future investigation.

The reader will notice that relatively fewer errors were made in judging Set 7 than in judging its counterpart Set 1, although both sets contained a maximally salient end stimulus. This might indicate a greater ease in judging the green end of the series. However, if this was true, then Set 6 should also have been judged with fewer errors than Set 2. The only reasonable interpretation for this occurrence is to attribute it to a group of exceptionally acute judges.

SUMMARY

An experiment was designed to investigate and clarify the concept of anchoring. Anchoring was defined as the special way in which certain response categories appear tied to certain stimuli.

Seven stimulus sets were selected from a systematically varied stimulus series. The complete stimulus series was composed of thirty-seven photographic slides, each containing thirty-six blue and green dots such that the entire series varied systematically from an all-blue slide to an all-green slide. This permitted the E to control the color mass of the stimuli selected for presentation.

An eleven point scale was used to express judgments. Seventy Ss were recruited from introductory psychology courses, and were randomly assigned to groups of five Ss. Half of the Ss judged greenness, and half judged blueness.

The main argument of the experiment was that the salience of a stimulus, rather than its placement in the series, determined anchoring. A salient stimulus was defined as a stimulus that is easily noticeable and readily associated with a response category.

Other hypotheses were offered relating the effectiveness of anchoring to the salience of the end stimuli, and the influence of anchoring upon judgments of adjacent stimuli to the salience of the end stimulus and to the distance of the judged stimuli from the end stimulus.

The data were analyzed in terms of errors, an error being defined as any incorrect association of a response category to a stimulus. An overall analysis of variance of errors indicated that the data gathered under the two color conditions could be combined into a single body of data. An overview of the data was then presented graphically by calculating the median and the interquartile range of judgments for each stimulus in a set. This analysis indicated that anchoring effects occurred as predicted.

Subsequently, an analysis of variance of errors for each set was run on each of the seven stimulus sets to provide a more refined analysis of the magnitude and extent of anchoring effects. Significant F-ratios were obtained on all sets with the exception of the mid-range set where no anchoring was predicted to occur. The F-ratios obtained decreased in significance as the salience of the end stimulus decreased, supporting the hypotheses.

It was suggested that current interpretations of anchoring would have to be revised to incorporate the concept of salience. The most acceptable interpretation is the subjective-standard hypothesis, which embraces salience as the key concept for explaining the selection of a stimulus as the subjective standard. The data of the experiment indicated that anchoring is not primarily a function of the placement of a stimulus in a series. Rather, for a stimulus to act as an anchor, it must be easily identified and associated with a particular response category.

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APPENDIX A

JUDGMENT RECORDING SHEET

JUDGMENT RECORDING SHEET

Instructions: You will be shown several series of slides projecting blue and green dots on the screen. The task before you is to judge the "blueness" or "greenness" of each slide presented, using an 11-point scale. In other words, you would judge the "bluest" slide as a 10, the "next-bluest" slide a 9, and so on, with the "least-bluest" slide judged as an 0. There are 11 slides in each series, so try to use all 11 numbers.

Please do not skip a judgment; make a judgment for each slide presented. Please make no audible responses. Are there any questions?